

The 1941 CARS - in color

POPULAR MECHANICS

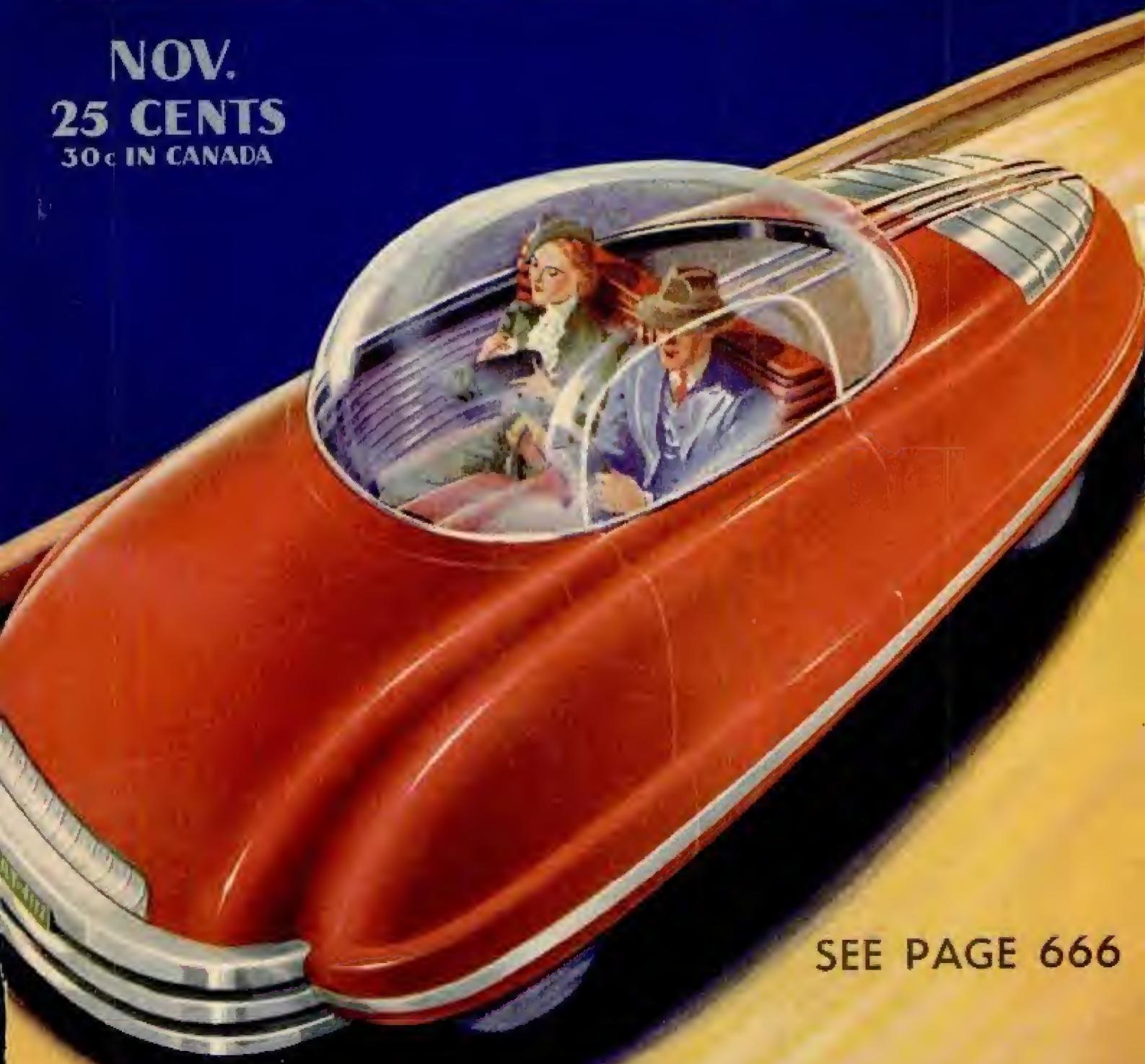
MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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SEE PAGE 666



HIS SMELLY PIPE WAS OVER-RIPE

- but he's out of the dog house now!



"OUT YOU GO, PETER! I won't marry a human smoke-screen! Where'd you get that tobacco anyway—in a fire sale? Snap out of it! Switch to a mild and fragrant blend."



PIPE AT A WEDDING? Sure! Pete made such a hit with his mild, grand-smelling Sir Walter Raleigh burley blend that even his mother-in-law smiled her approval!

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Here's the "One" for '41



IT'S A PLEASURE to remind you that this stunning 1941 Plymouth—so beautiful, so long, wide, low-swung—is a *low-priced car!*

You'll be delighted with its *Fashion-Tone Interior*—a miracle of color, fabric, appointments... with its 4-way Step-Up in Performance that gives you new mastery of hills, traffic, distance.

And Plymouth announces *Powermatic Shifting*, easiest ever...in all, 19 great advancements!

Today, see and drive this Big

See the Brilliant New Plymouth—Magnificent new Artistry of Design—New Powermatic Shifting
—New 4-Way Step-up in Performance—New Fashion-Tone Interior—
19 Great Advancements!

Beauty at your nearby Plymouth dealer! PLYMOUTH DIVISION OF CHRYSLER CORPORATION.

Other New Features

- COUNTERBALANCED TRUNK LID—goes up or down easily at a touch.
- NEW SAFETY RIMS ON WHEELS to prevent "throwing" of the tire in case of blowout or puncture.
- NEW SEALING throughout body against dust, water, noise, heat.
- 11 SMART NEW COLORS. New 2-tone color combinations available on the Special De Luxe sedans.



Powermatic Shifting—vastly easier—elimination of certain usual shifting motions.



Fashion-Tone Interiors: rich, luxurious, 2-tone upholstery in the Special De Luxe.



4-way Step-up in Performance—more horsepower, new transmission and axle ratios.

This One





Not a cannon, but the 130,000-pound shaft for a great electric generator being built by General Electric.



AMERICA'S first line of defense is American industry. It is to industry that the nation looks today for the armaments to protect America's high living standards, to defend the American way of life.

In the last two generations American industry has built a great nation. Its workmen, scientists, and engineers have given us electric lights in 24 million American homes and electric refrigerators in 13 million—conveniences which represent the highest standard of living in the world. And the manpower, the inventive and manufacturing genius, the

experience, the daring to tackle difficult tasks—assets which have helped to produce this high standard of living—are among America's strongest resources today.

Industry today undertakes the task of building, not only armaments, but, equally important, the machines that can be used to manufacture these armaments. And General Electric, which for more than sixty years has been putting electricity to work in America's peacetime pursuits, is today applying it to the new job—the job of defending the benefits electricity has helped to create.

G-E research and engineering have saved the public from ten to one hundred dollars for every dollar they have earned for General Electric

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Popular Mechanics Magazine

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

November, 1940

Vol. 74, No. 5

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Switching On the Rainbow

WHY change the wallpaper? The flip of a switch will change the color scheme of a room. On blustery winter days, turn on warm red and amber lights; on sultry summer nights, "chill" the room with cool blues and greens. That's how tomorrow's hostess will dress her home, switching on the rainbow to create the mood desired. Already it's being done with the new incandescent, fluorescent, ultraviolet and sodium vapor lamps that are a magic palette of color. The eight-page Coloroto section in December introduces home decoration with light.

Hunting the Secret of Life

TELL the world why grass is green and your fame will go down in history. The best scientists can't do it. If they could duplicate the chemical feat by which plants turn carbon dioxide and water into sugar, many of civilization's problems—like the dwindling petroleum stores—might vanish. A December story tells how near science is to the answer.

Next Month

WEEK after week the ocean liners of the air, the flying Clippers, take off from their American bases for tiny islands in vast oceans. Then they streak on to find "home base" unerringly. Two pilots are always at the controls; five are available. The navigator is constantly plotting the course. The radioman phones "home" every half hour. Read "Sailors of the Sky," a December feature that takes you aboard a Clipper for Lisbon for a glimpse of its busy crew at work.

Ideas for Your Home

YOU need not build a new house to benefit by modern improvements. Many of them come in "package" form. Shower stalls are ready for installation in a corner of the bathroom. Shades and screens outside the window help insulate the house. Bathroom scales that fold into the wall can be built in. A host of ideas for bringing the old home up to date in comfort and convenience are contained in a story next month, "Try These in Your Home."

Millions from Waste

PRUNE pits and pine needles, peanut hulls and whey are being salvaged from waste piles and fabricated into products worth millions. Oil crushed from grapefruit seeds, for example, can be used to fix non-fading colors in dresses. An interesting account of new and strange uses being developed for waste materials will be found in the December issue.

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SUCCESS-

Will You Pay the Price?

IF you are normal, you want the comforts and luxuries which are the by-products of success—a home of your own—a new car—the leisure to read—the means to travel.

You want these things very much.

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* * *

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nevertheless prefer to think that there's "nothing in it." That's the excuse they make for their futures.

If you—knowing these facts—are content to drift, you will not profit by reading further.

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IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described, in order to avoid possible liability for patent infringement.



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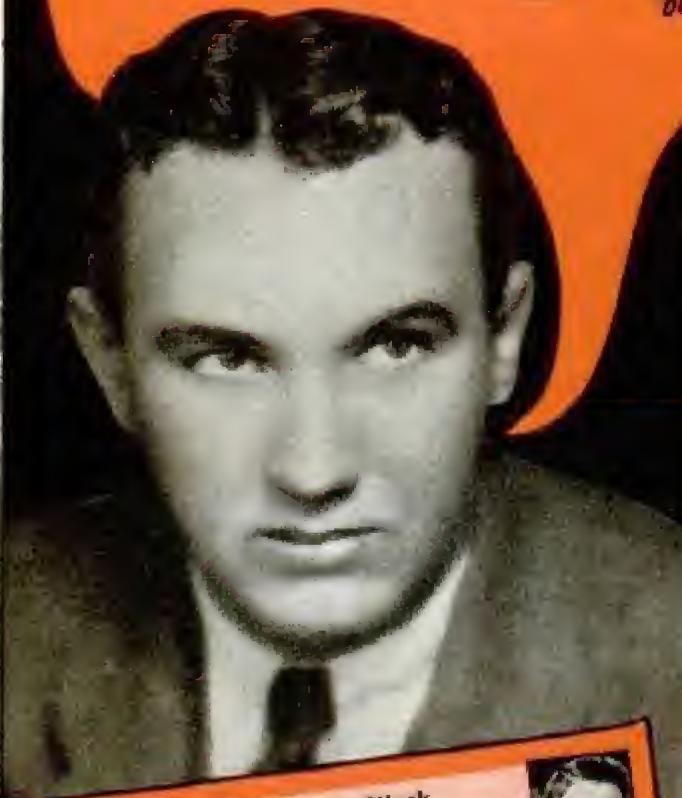
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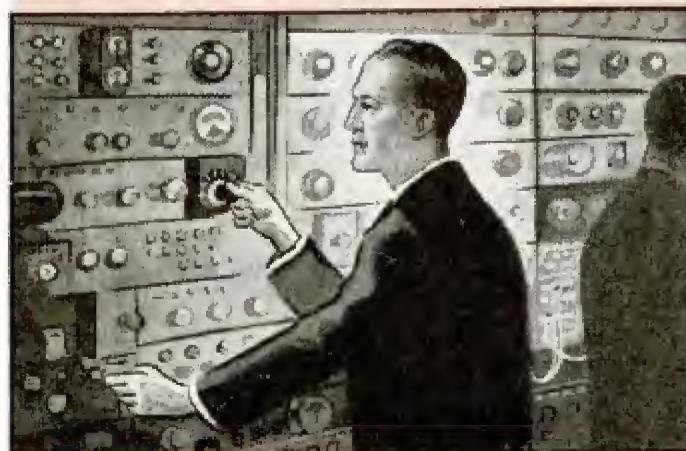
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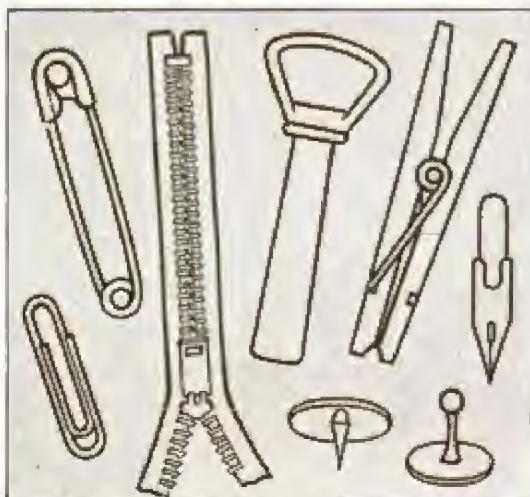
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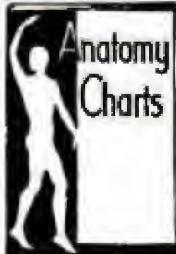
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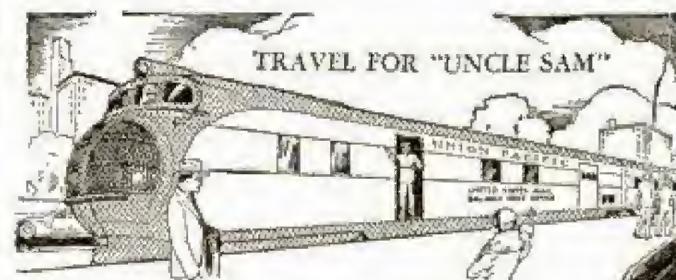


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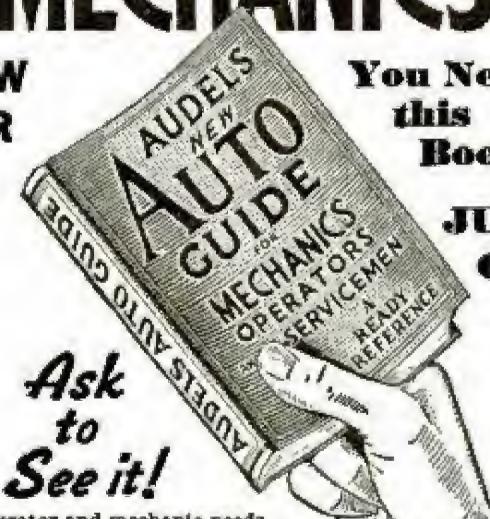
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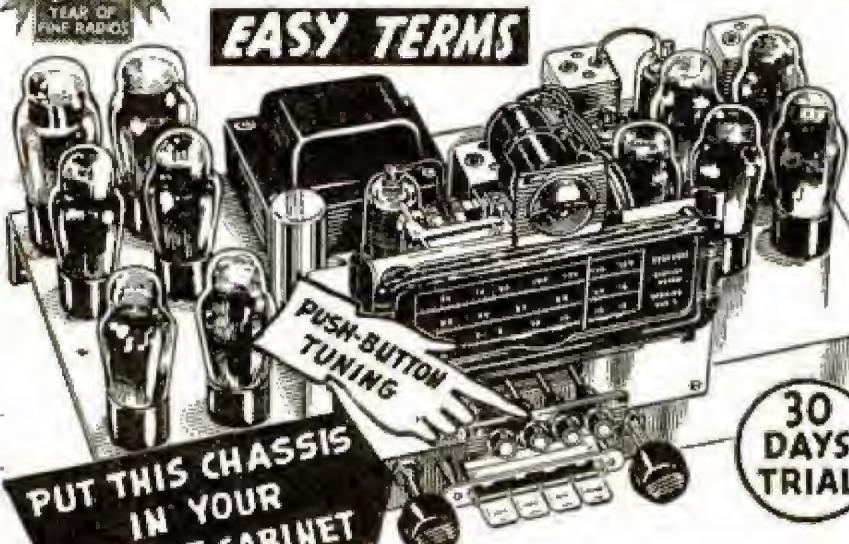
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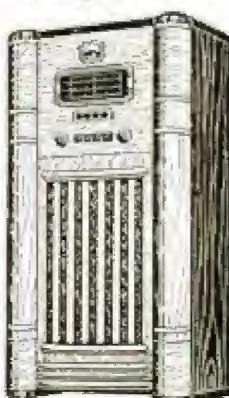
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ALL Dollars in your mail 100% yours—as "Co-Operator," supplying millions jobless satisfying employment information. We fill Co-Operator's orders! Co-Operative Service, 77 Swan, Buffalo, New York.

WILL You give us 5% first \$600 you make? Afternoons free! Work home. \$1,000 month reported (exceptional—full-time). Expect surprise. National, Box 1240-A, San Bernardino, Calif.

CREATE Self employment, that pays 50c to \$1 hour. Valuable instructions 25c. Homecraft Arts, Lakeside, Calif.

EARN Money compiling names. We tell you how. Inexperience, location no handicap. Goldilay Company, 1514 Long, Columbus, Ohio.

MAILORDER Opportunities, publication, plans, sell by mail. Harvey Teeple, Decatur, Indiana.

OPPORTUNITIES Unlimited—3 magazines, formulas, plans, 10c. Goodeve, Bergenfield, New Jersey.

MAILORDER Businesses build fortunes! Free literature explains your opportunity for mailorder profits! Jay, 1129 East 51st, Chicago.

MYSTIFYING Pig, moves eyes, ears, tail. Manufacture 1c. Fast seller. \$10 daily. Instructions \$1.00. Act quick. Gaddis, Co. 2224, Rahway, N. J.

START Film developing business at home—by mail. Make money. Complete instructions 25c. Circular free. Dunbar, Middlebush, N. J.

MAKE 20c On 25c sales. Liberty, Box 1704, Cleveland, Ohio.

BE Funny, make money. Learn gag writing. Stamp brings information. Don Ulsh Studios, B-518 Wrightwood, Chicago.

GENERAL Contest Bulletin. 22 big pages of contest helps. 10c. 1609 East 5th, Duluth, Minn.

MOULDS. Guaranteed, for casting toy soldiers, Indians, trappers, warships, sinker moulds. 244 kinds. Send 5c for illustrated catalog. Send \$1.00 for large sample mould. Henry C. Schlerck, 635 Spencer, Ghent, N. Y.

BE A professional scrapbooker. Big fees. Unlimited opportunities. Can be done at home. No competition. No capital needed. Write to Scrapbookers Guild, 59 Park Place, New York, N. Y.

"RAISE Earthworms for profit." new, interesting home business. Bureau Zoological Research, 106A Broadway, Peoria, Ill.

FORMULAS, PLANS, ETC.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Avenue, Syracuse, N. Y.

ELITE Formulas and plans; make and sell your own products. Descriptive booklet free. Elite Co., 214 Grand St., New York.

MONEY-MAKING Formulas—Thousands of new "make-it-yourself" trade secrets and compounds. Illustrated circulars free. F. Warren, 15 Park Row, New York.

PROVEN Formulas 25c. Satisfaction or money refunded. Norv Breuer, Loveland, Ohio.

FORMULAS—All kinds. Real moneymakers. Lowest prices. Catalog free. Clover Formulary, 106-PM, Niles Center, Ill.

FORMULAS: Latest, best, selected sellers. Literature free. Baran, Bay City, Mich.

ATHLETES Foot and poison oak. Itch formula—50c. T. Skele, 1814 Harrison, Butte, Mont.

MAKE Fast selling products. "Chemist Approved Formulas," Catalog free. Kemico, 12, Park Ridge, Illinois.

FORMULA Guaranteed to relieve toe itch. 25c. E. Page, 1705 Dogwood Place, Jacksonville, Florida.

ANY Formula \$1.00. Analysis. Assaying. Formula Supply, 1449 Vermont, Detroit, Michigan.

AUTHENTIC Formulary. Used by leading manufacturers, formula dealers. Instructions for easily making 10,000 profitable products. Supply sources. Complete book—224 pages, \$1.50. Postpaid C.O.D. Adams Brown Company, Chestnut Hill, Massachusetts.

YOU—Easily make-sell, today's largest-selling specialty-necessities! Stamp brings many unequalled opportunities. Miller's Chemists, Tampa, Florida.

160 SINGLE-INGREDIENT Formulas—No manufacturing. Information free. A. Kinford, Wayne, Penna.

THAXLY Formulas, processes, for successful products. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

ICELESS Ice! Colder! Cleaner! Cheaper! Instructions 25c. Duffy, Covington, Ky.

65 PROVEN Industrial formulas. Send \$2.00. Mundhenke, 531 S. W. 1st Ave., Portland, Oregon.

CHEMISTRY

FREE Catalog, chemistry, mineralogy, telescopes, binoculars, microscopes. Tracey Laboratories, Evanston, Illinois.

FREE: 40 Page catalog of chemical and laboratory supplies for amateur chemists. Wollensak microscopes and supplies, scientific books at big discount. JE11 Winn, 124 West 23 Street, N. Y. C.

FREE Chemistry catalog. Supplies at 5c! Equip complete laboratory. Kemkit Scientific Corp., 397P Bridge St., Brooklyn, N. Y.

CHEMICALS, Laboratory, glassware, apparatus. Send 3c for catalog CPI. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, N. Y.

SPECTROSCOPE For quick chemical analysis \$2.50. Kutting Sons, Campbell, California.

CHEMICALS In 5c quantities. Catalog 5c. Fleischer's Laboratories, Medford, Mass.

HELP WANTED

MAKE Big money demonstrating amazing Handyman Tool, 101 uses. Pull posts, roots, small stumps; Jacks up trucks, tractors, wagons; lifts buildings; stretches fences; splices wire; makes cider press; dandy auto bumper jack, etc. Lifts, pulls, pushes with 3-ton power. Write, Harrah, Dept. K-61, Bloomfield, Indiana.

CALL On service stations, factories, restaurants, businesses, professions: with lettered advertising uniforms, shirts, work suits, etc. 100 styles. Exclusive features. Big advance commissions. Free outfit. Topps, Dept. P-7, Rochester, Ind.

M. M. Earned \$1174 in spare time for exceptional "cellar crop" Snow-King mushrooms! Free book tells if your cellar, shed suitable. We buy crops. United, 3848 Lincoln Ave., Dept. 62, Chicago.

CELLULOID Menu covers. Sell easily. Samples dime. Transparent specialties, Box 15, Station "D," Los Angeles, Calif.

BIG Money taking orders: shirts, ties, hosiery, underwear, pants, jackets, raincoats, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-BG Lincoln, Chicago.

IF You want better job write immediately. Jobfinder, Box 2061, Dallas, Texas.

BOYS, Girls—Earn spending money: outfit free. Vosacek, 1634A Monroe, Chicago.

STEADY Work—Good pay. Reliable man wanted to call on farmers. No experience or capital required. Pleasant work. Home every night. Big money every day. Wonderful new proposition. Particulars free. Write McNess Co., Dept. 446, Freeport, Illinois.

GET The job you've dreamed of. We assist talented, industrious, ambitious men and women of all ages. Whether now employed or not. Job consultants that make good—not employment agency nor application-letter writers. For eye-opening booklet address Gatto Associates, Trenton, N. J.

EARN Money in your spare time taking subscriptions to Popular Mechanics. Unlimited possibilities, every family a prospect. Easy to sell. Bonus paid in addition to liberal commission. Send postcard for further details today. Circulation Dept., Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

AGENTS WANTED

SELL The Lightning Calculator, the new type calculating machine that adds, subtracts, multiplies and divides. Make big profits every day on the only deluxe machine on the market, available in a range of colors to suit your prospects' fancies. Guaranteed five years. 137,000 already sold. Easy to sell, because it is priced \$30.00 less than competitive machines. Agents wanted everywhere. For particulars write Lightning Calculator Company, Grand Rapids, Michigan, Dept. 18.

CHRISTMAS Card leader brings you quick cash profits. Sensational "Beauty Queen" 21-card assortment sells \$1.00. You make 100%. Ten other fast-selling assortments. Personal Christmas cards, 50 for \$1, up. Samples on approval. Chilton Greetings, 147 Essex, Dept. B-2, Boston, Mass.

FREE Samples easily sell mechanics Protek-Ur-Hands! Constant repeater. 100% profit. American, 491-P William, East Orange, N. J.

SELLS Like hot cakes. Big profits. New laundry soap flakes. Perfumes clothes when washing. Territory given. Sunset Laboratories, Lynbrook, New York.

AGENTS Make big profits on food products, bargain deals. Low wholesale prices. Rush name for trial outfit offer. Ho-Re-Co., 2810-U Dodier, St. Louis, Mo.

REVOLUTIONARY Window cleaning tool. Good Housekeeping approval. Only ten \$2.25 sales daily to housewives, factories, schools, stores will make you \$350.00 monthly. Carter Products Corp., 911 Front Ave., Cleveland, Ohio.

STOVE Lining—Furnace. Iron. Fits all. Patented. Circulars free. Benjamin Co., Granite City, Ill.

SELL Gabardines, reversibles, tweeds, jackets, etc. \$2.98 up. Larger commissions. Free outfit. Consumers Raincoat, 608 So. Dearborn, Dept. B, Chicago, Ill.

SELL Ready tied ties. Sample 25c coin or stamps. U. S. only. J. and G. Sturm, 39th Ave., Passaic, N. J.

FREE Assortment of actual packages foods, groceries, household products worth \$6.00. If you promise to show friends and neighbors and try to take orders. Fine profits. Spare time. Experience unnecessary. Zanol, 2036 Monmouth, Cincinnati, Ohio.

MAN Wanted to supply Rawleigh's household products to consumers. We train and help you. Good profits for hustlers. No experience necessary to start. Pleasant, profitable, dignified work. Write today. Rawleigh's, Dept. K-53-PPM, Freeport, Ill.

MAGIC Clothes brush. Revolutionary invention. "Erases" dirt like magic. Saves drycleaning. Sensational seller. Samples sent on trial. Rush name. Kristee, 121, Akron, Ohio.

WEAR Fine hose I send without cost with large outfit while taking orders for amazing new hosiery. Replacement guaranteed against holes, snags, and runs. Rush name and hose size. Wilknit, Desk RR-37, Greenfield, Ohio.

500% PROFIT. Gold and silver colored sign letters. Offices—stores. Large sizes 1c. Free samples. Modernistic, B-3000 Lincoln Ave., Chicago.

CHRISTMAS Card agents: Premium doubles sales! Box 451M, Fitchburg, Mass.

OPERATE Steady business resilvering mirrors. Making chipped glass nameplates, signs. Write Sprinkle, Plater, 128, Marion, Indiana.

PATENT Combined brush and comb, to eliminate dandruff. Free sample. Peter Chiarello, 1319 East Falls Street, Niagara Falls, N. Y.

FASHION Styled organdie aprons. Fast selling item. 100% profit. Write today. A. Brenmore, 55 West 42nd, New York.

AGENTS! Men's suits 88c, pants 23c, top coats 50c, ladies' coats 36c, dresses 10c. Other bargains. Catalog free. Portnoy, 566-P Roosevelt, Chicago.

HAND Painted copper Christmas cards; 60c box. Sell \$1.00. Desert Studios, Box 1765, Tucson, Arizona.

PHYSICAL Perfection course 10c. (Agents \$1.00 per 100). Sid's System, Southgate, California.

AGENTS! Two a day—keeps the poorhouse away. See advertisement page 133A. National Laboratories.

AGENTS Rush 25c for sample spectacular seller. Ward, 97B, Saybrook, Conn.

XMAS Bird pictures with real feathers. Sample 10c. Importer, C. Staff, No. F. 8716 Lambert, Detroit, Michigan.

AGENTS—200% Profit on amazing new discovery. Cleans, polishes, waxes cars in 30 minutes. Magic all-purpose polish. Instant demonstration sells most skeptical auto owner and housewife. Send 25c for 3cc size. Enduro, 2420-F Grand River, Detroit, Mich.

SELL New, used clothing from home, auto, store. Men's suits 77c, leather jackets 29c, overcoats 54c, dresses 20c, ladies' coats 36c. Other bargains. Catalog free. National, 436 East 31st, Chicago.

BIG Money taking orders: shirts, ties, hosiery, underwear, pants, jackets, rain-coats, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

START Profitable home business manufacturing soapless suds. Amazing discovery. Eliminates hard scrubbing. Costs 1c quart. Formula, sample 25c. Details free. Linothex, 14006 Coit, Cleveland.

SELL Used clothing bargains from home, store, auto. Shoes 15c, men's suits, overcoats 75c, dresses 10c. Experience unnecessary. Free wholesale catalog. Superior Jobbing, 1250-GD Jefferson, Chicago.

PHOTOSTAMPS Personalizing stationery, outfit 50c. Excellent opportunity. Royal Service, P.O. Box 1275, Washington, D. C.

SPLENDID Earnings for part time work—A quality line that positively repeats—Build up or work with your present route. Write for full particulars. Sterling Food Products, 3715 Avalon, Los Angeles, Calif.

AGENTS. Our door openers will help you make more sales. Write Silksaver, 5125 Pensacola, Chicago.

"SOL-VO." Brand new invention. Genuine motor residue solvent. Greatest internal motor cleaner known. Harmless! Distributors wanted. Thermo-Solvell, Peoria, Ill.

150 AMAZING Money-making secrets. Free samples. Formico Novelty Service, Dayton, Ohio.

CHRISTMAS Cards. Largest profits from complete line box assortments, inexpensive and deluxe personals, stationery. Heather Greetings, Springfield, N.J., Mass.

SPOTS-OFF—Amazing spot remover. Whirl-wind seller. Great repeater. Splendid money-maker. Write Hopkins, 564 Florence Branch, Los Angeles.

FREE Water and our concentrates make 68 products. We supply labels, bottles. Enormous profits. Qualeo, E-20030 Russell, Detroit.

VALUABLE Gifts—watches, cameras, etc.—in addition to doubling your money by easy selling of our 64 piece Masterpiece Box of French-fold Christmas cards and seals. Cards and seals in attractive colors by a master designer, all 64 pieces cost 25c—sell on sight at 50c. Write for free sample set, and gift plan today. Be first in your community with this quick seller. American Card Co., Box C-95, Lancaster, Penna.

ONE Reference and 25c stamps bring you sample outfit to start making money immediately with Mexican art goods. Tremendous market. Big profits. Marquez Company, Apartado 1176, Mexico City.

MONOGRAMMING Automobiles real money maker. Write for samples. International Co., Box 9360, Philadelphia, Pa.

EVERYBODY Buys sensational "Golden Rule" assortment. 21 Christmas folders including souvenir calendar. Free Christmas motto with each box. Unparalleled value. Costs you 50c, sells on sight for \$1.00. Actual retail value \$3.00. Ten other bargain assortments. Everybody, all ages, making easy-as-pie sales. Nothing to lose. Sample "Golden Rule" assortment sent on approval, with free offer. Silver Swan Studios, 320 Fifth Avenue, Department 46, New York.

WINDOW Sign letters. Penny each, large sizes. New styles. Absolutely beautiful. Free samples. Atlas, 7941 Halsted, Chicago.

AGENTS: Smash go prices! Santos coffee 12c lb., 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. Christmas cards, 21 in box, 14c. 150 other bargains. Premiums. Experience unnecessary. Carnation Company, P.O. St. Louis, Mo.

CALL On service stations. New item, necessity, big profits. Knipp, Long Beach, California.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfit, Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

FREE Sample—Amazing cleaner: sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for short order decalcomania name plates. "Ralco," 1305 Washington, Boston, Mass.

SUCCEED With your products. Make them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxby Co., Washington, D. C.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 5-P West 24th, New York.

AGENTS—300% Profit selling gold leaf letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

GOOD Paying business silversing mirrors, plating autobarts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. N., Decatur, Ill.

AGENTS — Opportunity make money: book containing 127 successful business plans: home-office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

AGENTS — To mail our literature. Good profits. Home business. Maywood, 1105-1107 Broadway, New York.

HIGH-GRADE SALESMEN

BUILD A profitable lifetime business selling the only low cost nationally known automatic combined fire extinguisher with alarm having Underwriters Laboratories listing. Ten year successful record. Openings for producers in choice territories. AutoFyrstop Company, Dept. P-1, 2035 Washington Ave., Philadelphia.

SELL Chestnut chicks. Make real money. Wonderful opportunity for aggressive salesmen with car, calling on farmers. Illinois' oldest U. S.-approved hatchery, operating entire year. Liberal commission paid promptly on immediate and future orders. Exclusive territories. Write for details today. Chestnut Hatchery, Box 117A, Chestnut, Illinois.

SCULPTURED Ornamental, religious, patriotic plaques. Retail \$1.00 to \$3.00. Liberal commissions. Write. Zinkote Sales Co., 3867 Harvard Rd., Detroit, Michigan.

FOUR Color processed business signs. Sell fast. 400% profit. 20 assorted \$1.00. Tinselled sacred mottoes, 12 assorted, \$1.00. Samples 10c. Lists free. Johnson Sign Service, Morristown, Tennessee.

WANTED: Permanent representative for Hoover uniforms—waitresses, doctors, nurses. Slack ensembles, aprons, frocks. Smartest styles. Finest quality. Exceptional commissions. Line free. Hoover, 251 W. 19th St., Dept. KK-10C, New York City.

NEW Kind of man's shoe increases height two inches. Also styles that zip on and off. Pays salesmen ready cash every day. Complete sales kit, including almost 250 styles for men and women, sent free. No experience needed. Write manufacturer established 38 years. Mason Shoe Manufacturing Company, Dept. BC-41, Chippewa Falls, Wisconsin.

SENSATIONAL Quick-cash opportunity. My route building plan gives you chance for good steady income. Real future. Handle regular route local stores. Collect, deliver orders for famous 5c—10c counter display goods. Nationally advertised in 120 magazines and radio. Show merchants proven plan for beating competition and increasing sales, profits. Experience unnecessary. Use home as headquarters. Chance to operate Silver Fleet service truck. Facts free. World's Products Co., Dept. 10-E, Spencer, Indiana.

SELL Complete line calendars and printing at cut prices. 100 four color calendars \$1.05; 2,000 business cards \$1.50; 1,000 envelopes or statements, etc. \$1.75; 25 printed sales books \$1.50; 1,000 process embossed cards \$1.50; 2,000 two-color labels, free holder \$1.50; 2,500 printed handbills \$1.75. One-third comm. Free outfit. Bargain Print. Co., 189-F W. Madison, Chicago.

MAKE Money selling calendars. Largest, most complete line in field. Widest price range. Newest designs—De Luxe, hangers, direct on, commercial, thermometer, metal, miniature, Christmas card calendars. Big commissions. Four different selling outfits sent free. Write today. Capitol Calendars, Dept. 511, Gladys at Hamilton, Station D, Chicago.

ADVERTISING Book matches—World's largest "direct selling" book match factory offers advance cash earnings calling on every type of business. Experience unnecessary; full, part time. Low prices for high quality; quick deliveries, help you get orders. Good repeat profits. Free kit, instructions. Match Corp. of America, 1343 West 48th Pl., Dept. E-11, Chicago.

REVOLUTIONARY Loud speaking inter-communication system. Talk privately, back and forth, to one or any number of stations, even 2,000 feet away. Any station originates calls. One electrical connection. No servicing. Easily installed. Guaranteed. Technical experience unnecessary. Two-minute spectacular demonstration. Thousands prospects, factories, offices, stores, auto dealers, lumber yards, restaurants, etc. We carry the accounts. Free trial to customers—sells itself. New low price. Men earning high as \$150 week. Protected territory available. Free demonstrator offer. Inter-Communication System of America, Dept. 310, 2440 Lincoln Ave., Chicago.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

BIG Firms need men—you. With or without experience they offer you daily cash money for your spare or full time. You can choose the company from hundreds of well established firms who are ready to help you make money working for them. No matter where you live or what your age is, here is your chance. Long established magazine tells how. Six issues sent to you free to get acquainted. No obligation now or ever. Send name on card today to "What to Sell," Box M11, 168 N. Michigan, Chicago, Ill.

SALESMEN. Route men, distributors. Cash in our new fast selling 10 cent side line that will pay all expenses. Write today. Lovely, 1734-A Washington, St. Louis, Mo.

SELL New simplified time saving book-keeping system. Big profits. Record Pub. Co., 2628 Irving, No. Minneapolis, Minn.

SELL Grocers, butchers, restaurants, new changeable paper window signs. 400 varieties, large commission. Rueby Displays, 29 North Water, Rochester, N. Y.

SALESMEN. Distributors. 200 items, brushes, mops, marvelous magnetic brush excels vacuum cleaner. Highest commissions. Neway Brush Works, Hartford, Conn.

ADVERTISING Book matches—World's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches, complete cut catalog. 9 color combinations makes selling easy. Commission in advance. Superior Match Co., 7530 Greenwood, Dept. M-11, Chicago.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$250 weekly. Farrell cleared over \$1,000.00 monthly. Write F. E. Armstrong, President, Dept. PM, Mobile, Ala.

CALL On friends with greeting card assortments. Easter, birthdays, other occasions. Big demand. Big profits. Also personal stationery. Experience unnecessary. Samples free. Wallace Brown, 225 Fifth Ave., Dept. T-34, New York.

AT Home, your own manufacturing business, making popular \$1 novelties. Cost you 3c to 15c. Everything supplied. Write So-Lo Works, Dept. N-842, Cincinnati, Ohio.

SALESMEN: America's finest sideline. 40% commission daily. 1000 fast selling repeat items. Every business uses and must buy. No investment now or ever. Sales portfolio free. Willens, 2130 Gladys, Dept. CC, Chicago.

SELL Quality portraits, frames. Lowest prices—big profits. Catalogue free. Friedman's Studio, 528 Cornelia, Chicago.

"**GALLOPING** Ivores"—Nicknamed by salesmen. It's really hot! Plenty immediate—repeat commissions. Every retailer—service station wants it. Hurry! Universal, 2222 Diversey, Dept. C511, Chicago.

SELL Custom shirts. Liberal commission. Outfit free. Merit Shirts, Bridgeport, Conn.

EXPERIENCED Salesmen for direct selling of patented made to measure form fitted shirts. Cannot be purchased in stores. Excellent side line for tailoring salesmen. Prices \$2.00 to \$5.00. Very attractive proposition. Bona-Fit Shirt Co., Paterson, N. J.

DISTRIBUTORS. Crew managers, organizers of agents, send quick for news of amazingly-seasonable device for travelling autoists. Thirty-five cents retail or more value. Quick easy seller. Light, permanent. Immense commissions. Act promptly. Nicholas Company, 7137 Cottage St., Philadelphia, Penna.

CHRISTMAS Leaders! 21 piece flash assortment 15c; 50 imprint folders 25c; 100 piece gift wrap box 25c. Bargain packages 1c each. Samples \$1.00 postpaid. Illustrated catalog free. Elsco, 440 North Wells, Chicago.

CALENDARS—Beautiful complete line, all sizes, including jumbos. Samples free. Also Christmas cards. Fleming Calendar Company, 6539 Cottage Grove, Chicago.

BLADES—Big profits. Best quality. Factory prices. Postpaid. Ace Blades, Buffalo, N. Y.

A **REAL** Future for you with Red Comet fire control products. Low prices. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Building, Littleton, Colorado.

EXCELLENT Opportunity selling our complete line of brushes, largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

EDUCATIONAL AND INSTRUCTION

WANT Your pay raised? What are you doing to deserve it? Since 1897, our promotion training has fitted graduates for better paid positions. Accounting, air conditioning, architecture, drafting and design, electricity and 11 other big commercial and industrial lines. Also complete high school (many finish in 2 years) and liberal arts. Selective employment service for advanced students and graduates. Big bulletin and employment facts free. State line of work you like best. No obligation. Write immediately to American School, Dept. C-845, Drexel and 58th, Chicago.

BLUEPRINT Reading taught by mail. Write Blueprint Reading Institute, Box 5682 Metropolitan Sta., Los Angeles.

SIMPLIFIED Shorthand. First six lessons dime. Speedscript Company, 1127 Mississippi, Pittsburgh, Penna.

DRAFTSMEN—Earn extra hundreds. Introductory detailed saleable ideas, \$1. Guaranteed. Draftsmen's Foundation, West Medford, Mass.

"**HOW** To Break and Train Horses"—A book every farmer and horseman should have. It is free; no obligation. Simply address Beery School of Horsemanship, Dept. 11011, Pleasant Hill, Ohio.

EARN More money—Learn decorating, paperhanging, graining, marbling, pictorial and sign painting. Catalog free. Chicago Painting School, 102 West Lake Street, Chicago.

WELDING—Electric arc. Learn profitable trade quickly through actual practice. Individual welder instruction at bare cost of materials. Full particulars free. Valuable welding lessons book 50c. Hobart Welding School, Box M-11404, Troy, Ohio.

LEARN Auto mechanics, body, repairing, welding electricity, refrigeration, Diesel, Stevenson's, 2008A Main, Kansas City, Mo.

WATCH Repairing is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Co., 500 Sherman, Dept. K-2001, Chicago.

LEARN Real estate through home study by twelve experts. High commissions, easy, reasonable, new, college education not necessary. Write Morrison School, 100 North LaSalle, Chicago, Illinois.

AUTO Finance course, \$7.50 postpaid. Nebraska Finance Co., Lincoln, Nebraska.

AIR CONDITIONING—Electric refrigeration. Rapid growth creates big demand for trained men. Earn up to \$35-\$50 weekly. Write for free facts. Utilities Engineering Institute, 1314 Belden Ave., Dept. 10Y, Chicago.

CLINICAL Laboratory technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 494-E, Elkhart, Indiana.

HIGHER Arithmetic teaches shortest methods of figuring. Frederick A. Smith, 2410 Bernard Street, Chicago.

"**HOW** To Win a Job and Keep It." "125 Ways to Make Money on Your Typewriter," "Modern Webster Dictionary," and "Holy Bible." All new books, \$1.00 each, postpaid. Bookhouse, Box 251, Tampa, Florida. Satisfaction or money refunded.

U. S. government jobs, men, women. New plan. Quicker start. Free particulars. National Service Bureau, 610 South Broadway, Los Angeles, Calif.

WANT Super memory? Write "DY." Info Company, Box 1122, Chicago.

CONSTRUCTION Men learn hoisting engineering. 200 questions and answers \$2.00. H&P Pub. Co., Sta. H, Buffalo, N. Y.

CLAIM Adjusting, complete \$5.00 course prepaid 25c silver. Box 302, Alhambra, California.

WANT A government job? Commence \$105-\$175 month. Men, women. Prepare now at home for examinations. Full particulars and list positions free. Write today. Franklin Institute, Dept. K3, Rochester, N. Y.

DEFEND Your future! Prepare for chemical, electrical, refrigeration, or radio career. No tuition. Diploma. Particulars. Bookery, Box 3941, Cleveland, Ohio.

LEARN Watchmaking. Material instructions for start and wholesale supply catalog, all \$1.00. Refund not O.K. Stewart's, 721 Olive, St. Louis, Mo.

DRAFTING. Mechanical, sheet-metal, home taught. Davison Technical School, 7 East Grand, Detroit.

LEARN Telegraphy! Opportunities now available to beginners due to new railroad retirement act. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

U. S. Govt jobs pay up to \$40 a week to start. Get ready for next examinations: railway postal, rural carrier, mail carrier, office help and others. Free book tells how you may qualify. Write quick. Patterson School, Dept. P. M., Rochester, N. Y.

CLAIM Adjusting. Excellent pay. Investigate tragic accidents, fires; outwit fraudulent claimants. Burns School, 311 Morewood, Pittsburgh, Penna.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

FREE Big list of helpful books. Popular Mechanics Press, 200 E. Ontario St., Chicago.

PLAYS, STORIES, MANUSCRIPTS

FREE Information on selling your stories, articles. Charbeth, Box 62, Philadelphia, Pennsylvania.

SEND Best story, play—for revision, marketing. Free reading. Childress, McMinnville, Tennessee.

PUBLISHERS Need manuscripts. Information free. Besner-P.M., 30 Church, New York.

FREE Test for writers! Send postcard for free market test. Hundreds of paying markets seek stories and articles. Learn the markets best suited to you—and sell. We help you! No obligation! Comfort Writer's Service, Dept. 519, St. Louis, Mo.

STORIES. Articles, books wanted for publication. New, unknown authors assisted. Manuscripts marketed, revised, criticized. Christopher Carr, 3636A Chestnut, Philadelphia, Penna.

YOUR Story ideas built into salable short stories—revised, marketed. Free analysis. Author's Bureau, Rhinebeck, N. Y.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

BE A professional signwriter. No training necessary. Send for book—"Modern Signwriting Simplified" 25c cloth. Showcarder, 523 N. Prior, St. Paul, Minn.

ANIMATED Cartooning! Illustrated! Professional! Home course! (Copyrighted) simplified method! Compared to \$50 courses! \$5 complete! Particulars 3c. Hazel Studio-Animatooning, Box 246, Hollywood, California.

AMATEUR Cartoonists, earn cash, spare time, copying advertising cartoons. Ad-Services, Arkyle, Wis.

NEW Cartoon selling plan \$1.00. Particulars free. Smith's Service, Wenatchee, Wash.

TEST Your cartooning ability. Send dime for big test picture chart, full details of outstandingly successful simplified method. Landon School, 199-N National Bldg., Cleveland, Ohio.

MIGS School of Cartooning. Send for free details. Box 393, Springfield, Mass.

CRAY-ARTS! Now anyone can draw nature scenes instantly. Discovery amazes everyone! Special crayons—no lessons. Folder, original drawing, free. Write, Cray-Arts, complete \$2.00 (Canada \$2.25). Townsend Company, 309-E Cutler Bldg., Rochester, N. Y.

LEARN To draw—by simplified method. Complete course \$1.00. John Leon, 121 So. Hill St., Los Angeles, Calif.

ART Magazine including directory art books—free! Send 10c postage. Art Headquarters, Doty Street, Madison, Wisconsin.

PEN And ink drawings. Let us draw your advertising and catalogue illustrations, from photos, copies or objects. Best work and fair prices. Heraldic Studios, 1914-P Oakdale Avenue, Chicago, Ill.

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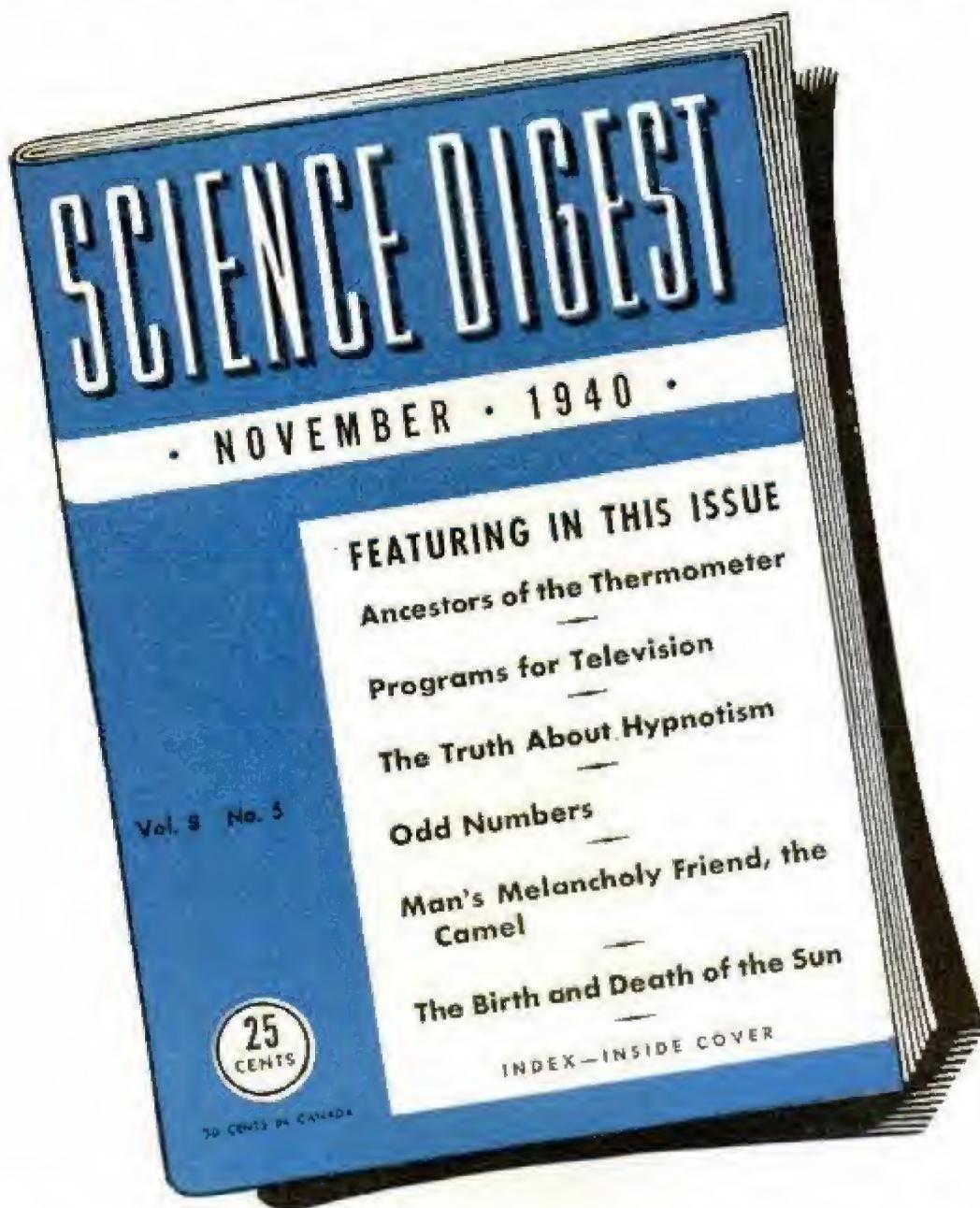
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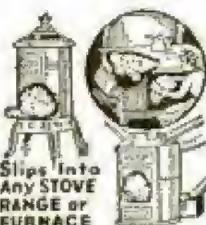
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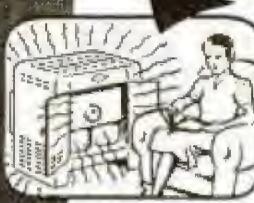
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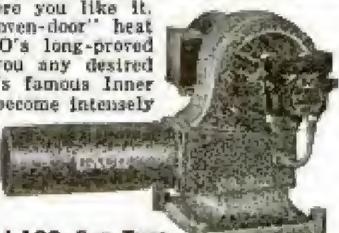


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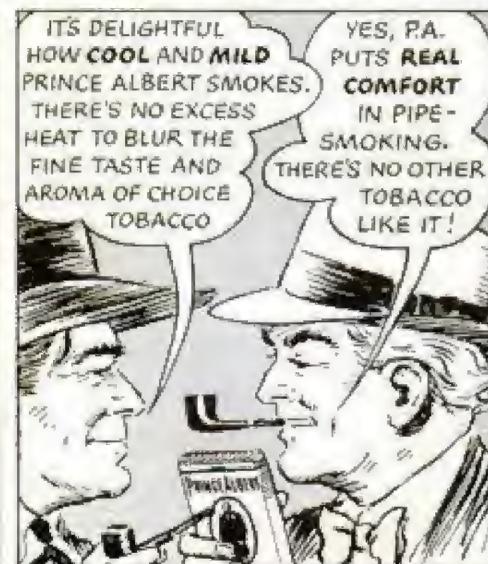
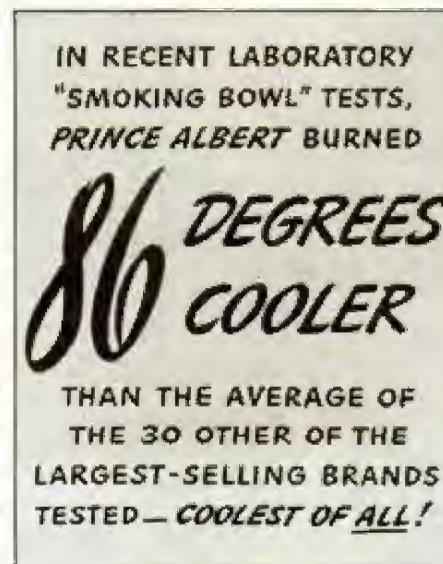
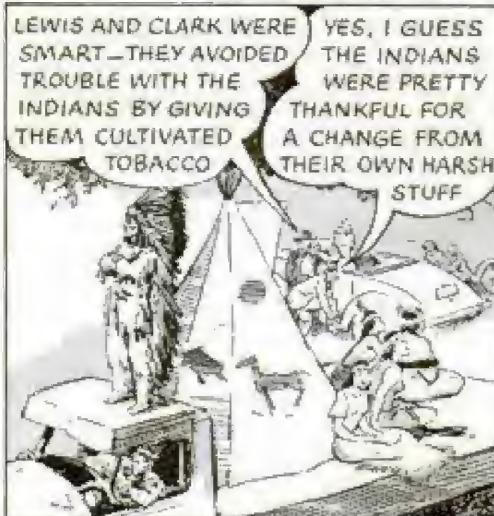
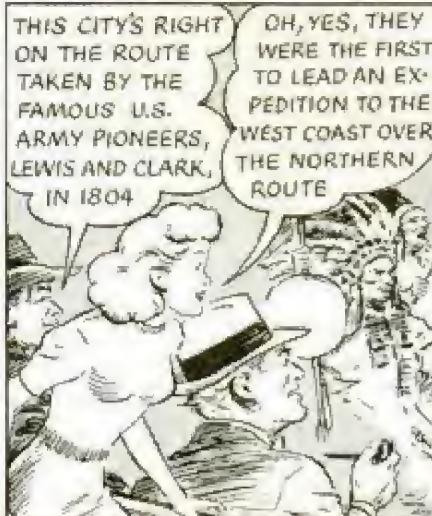
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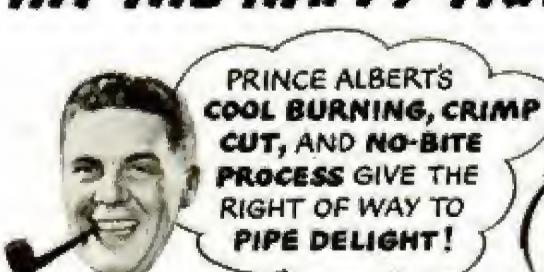
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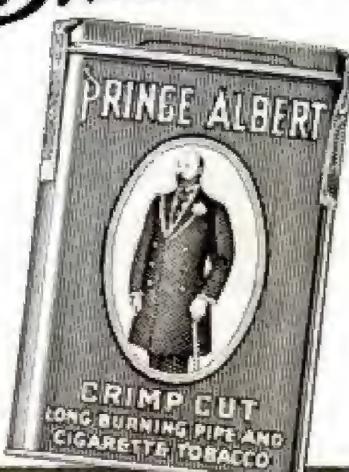
OL' JUDGE ROBBINS



HIT THE HAPPY TRAIL



To Smoother Smokes



Copyright, 1940, R. J. Reynolds Tab. Co., Winston-Salem, N.C.

50

pipefuls of fragrant tobacco in every handy pocket tin of Prince Albert

PRINCE ALBERT THE NATIONAL JOY SMOKE

Popular Mechanics Magazine

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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 74

NOVEMBER, 1940

No. 5

80,000 FLEDGLINGS for DEFENSE

Leaged
PILOTS by the thousands and ground crew specialists by the tens of thousands will be needed to man and service the 50,000 planes a year which experts say are needed to defend this country.

In this long-range program, the Civil Aeronautics Board has undertaken the job of building up a huge reservoir of civilian pilots, qualifying them for specialized training which will convert them quickly into fighting pilots. By June 30, 1941, eighty thousand will have completed civilian training. Twenty-five thousand already have been graduated.

As a result of the Civil Aeronautics program, the United States will not be faced with the unhappy situation which existed at the time of the World War when it became necessary to train military pilots with such terrific haste and cost in human life. The pressure was so great then that more student pilots were killed in the training process in American camps than were killed afterward in air battles over France. Those



Clustered around their instructor, who is seated in the cockpit of a basic training plane at the "West Point of the Air," Randolph Field, Tex., four of America's future army pilots learn by gestures about a maneuver in the air. After this lesson on the ground they'll go aloft to try it.



who complete the preliminary and secondary courses of the training program will have had the equivalent of the military primary training. They will be young men who have cleared the first hurdles, who have demonstrated their mental and physical fitness for the highly specialized function of piloting an airplane, and as a result of this training their chances of successfully and safely completing the intensive Army and Navy flying course will have been increased enormously.

Of the 80,000 pilots completing their training by next June 30, the government expects to have a reservoir of at least 68,000 airmen qualified for the Army and Navy training courses, after allowing for those who fail to make the grade or drop out for other reasons. While this reservoir is being filled, the nation's military services are turning out hundreds of fighting pilots—men who enlisted and took the complete Army or Navy course instead of getting civilian licenses first and then moving on to military training.

Regarding the Civil Aeronautics Board's program, Robert H. Hinckley, assistant secretary of commerce, who has been in charge of the training plan, says:

"The initial experimental program was concluded with the graduation of 313 stu-



Cadets, top, study 1,200-horsepower engine. Center, supply sergeant checks engines for training program. Lower left, students examine skeleton of an elevator; right, teaching technique of parachuting



dents in the spring of 1939 at thirteen colleges throughout the United States. Out of this group about one-third applied for further training in the Army and Navy. Nearly all who applied for military training were accepted.

"Those who did not apply for advanced or specialized military training continued with their college studies and kept their interest in aviation through flying clubs. Banding together in the purchase of one or more planes, many of the original group have maintained and improved their pilotage with regular practice. We hope to see the club idea further adopted and developed in proportion to the expanding program. This method not only helps maintain the reservoir for national defense, but it stimulates and promotes widespread private ownership of airplanes.

"Following the successful conclusion of the original experimental program nearly 10,000 students were enrolled in the fall of 1939 in what became known as a preliminary training course. More than 9,000, or about ninety per cent, finished the course last spring. By this time, 1,139 students who continued with summer flying have completed the secondary phase of training.

"The preliminary course gives a student between thirty-five and fifty hours of flight training in the basic principles of aviation. He is taught to fly a straight course, to land and take off, to land without



Upper left, drilling rivet holes in bomber's wing at San Diego vocational school; right, army parachutist makes "captive" jump from 125-foot tower. Center, studying model of a plane's fuel system. Bottom, illustrating maneuvers with model planes



One of the first things a flying cadet learns about is the "aerial life-raft" or parachute, top. Center, one of the new BT-14 basic training planes. Right, refueling at Randolph Field

power as in a forced landing, and to recover from stalls and spins. We require that each student have a minimum of thirty-five hours but he may be given fifty of dual instruction and solo practice if his instructor feels that he needs it. Our records show that the average preliminary student gets thirty-seven hours of dual and solo practice. The course also includes seventy-two hours of ground instruction in the theory of flight and other pertinent subjects.

"The secondary course includes an addi-

tional forty-five to fifty hours in the air and an additional 145 hours of ground instruction. Our records show that secondary students get an average of forty-four in aerobatics, cross-country and other flight training. Thus a student who has completed both the preliminary and secondary courses has flight training equivalent to the primary courses given by the Army and Navy.

"Besides the Army and Navy, numerous opportunities are open to graduates of the two civilian flight courses. The industry is expanding rapidly and nearly all will be absorbed in one or another aviation occupation if they so desire. Those who do not find a place to keep up their flying practice will be provided with the fifteen hours of flying required annually to keep a private pilot's certificate active.

"Combining the flying



schools, the flying clubs and other efforts, we aim to establish an active flight-training program on virtually every airport in the United States where it will not conflict with air-line traffic.

"During the past school year the training program operated with thorough effective-

R72
R846

ness in centers distributed through every state in the union, Alaska, Hawaii and Puerto Rico. At these centers 538 private commercial operators were organized to furnish the controlled and proven course of flying instruction. Facilities for ground-school instruction were made available at 435 colleges and universities. In seventy-five communities training was conducted on a non-college basis and graduated 750 students. More than 400,000 hours of flight training were given in the combined program. Colleges participating this fall total 499 in 202 communities.

"Civil Aeronautics recently graduated seventy-seven students from two experimental schools employing new types of aircraft designed to eliminate the spinning characteristics of the conventional airplane. The spinproof airplane, besides great inherent stability, has a simplified control system and is therefore easier to fly. At the same time it is less maneuverable than the conventional type and is therefore unadaptable to acrobatics and other military requirements. The spin-proof airplane is intended essentially as air transportation for the individual who would like to own and pilot his own airplane but does not have the time to apply himself to the more exacting pilot requirements of other types.

"Applicants for the government's preliminary flying course must be between the ages of eighteen and twenty-six and must pass a rigid physical examination. It is intended to be equivalent to the Army and Navy medical requirements. College students must meet the educational requirements of their schools. Non-college flight students are required to attain a high standing in the ground course given prior to their flight training. At this time there are approximately 15,000 non-college applicants competing for approximately 2,000 vacancies.

(Continued to page 147A)

Army's Split-Trail Field Gun Fires Shell Almost Vertically



Acme
For high-angle firing, the front of the gun carriage is raised on a jack, forming a tripod with the split trail

Its split trail enables the U. S. army's new experimental 144-millimeter "T-3" howitzer to fire almost straight up, higher than any other army weapon. It sends a ninety-five pound shell over a range of 10,000 yards. The gun was put in action for the first time recently on the artillery range at Fort Bragg, N. C. The front of its carriage is raised on a jack to form a tripod for firing.

"Baby Blitzkrieg" Car Given Test as Troop and Supply Carrier

Two-cylinder economy is offered in two small cars proposed to the U. S. army for troop and supply transports. One is an open car designed to carry four fully equipped soldiers and ammunition at speeds up to fifty miles an hour, traveling fifty miles on a gallon of gasoline. The engine is air-cooled. A similar car of the "covered wagon" type is offered for the transportation of supplies and equipment as well as to carry soldiers.



Crosley
These two cars, suggested for military use, are powered by two-cylinder air-cooled engines economical in fuel use

Target Trap Fixed to Rifle Is Operated by Spring



Below, loading the target into the throwing arm; above, aiming at the target after its release

Skeet and trapshooters can toss up their own targets with a spring-operated trap that fastens to the barrel of the rifle. An adjustment on the spring permits throwing the target near or far. The target thrower weighs fourteen ounces and fits almost all single-barrel .22 caliber rifles or .410 bore shotguns. Released by a separate trigger, the throwing arm comes to rest underneath the barrel without spoiling the aim.

Trailer Brake-Control in Auto Mounted at Steering Wheel



Hand control of trailer brakes for the convenience of automobile or truck driver is provided by a unit fastening to the dashboard or steering column. It permits brakes to be applied in-

dependently of the car brakes, thus overcoming the tendency of the trailer to jackknife on slippery roads. The equipment includes two gauges to show vacuum available in the system and the applied vacuum in the control lines.

R843

Remote Detonator for Bombs Effective for Two Miles

Claimed to work at distances up to two miles, a remote-control device invented by a Californian explodes bombs or other explosive charges. A directed, or focused, invisible beam, like a radio wave, is said to be the secret of the detonating machine. One anticipated use of the device is the setting off of enemy bombs that fail to explode, thus eliminating the risk of attempting an examination of the explosive. Another use might be in blasting, with the detonator replacing fuses and unhandy electrical equipment.



Inventor with device which projects an invisible beam that will set off explosive charges

Retractable Curb Divides Boulevard Traffic

4258 14th Chicago Park District

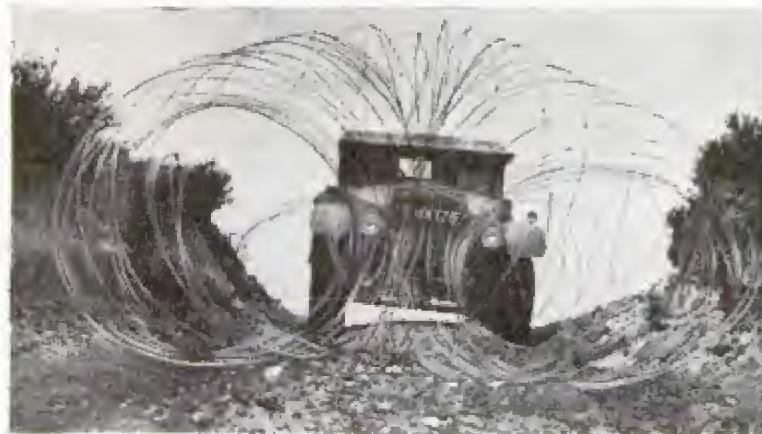


Curb that vanish into the pavement along a two-mile stretch of lake shore boulevard in Chicago permit division of the highway into six northbound and two southbound lanes during the evening rush hour, the reverse during the morning rush, and four north and four southbound lanes the rest of the day. Without this arrangement a twelve-lane boulevard would have been necessary to handle the heavy traffic. Controlled from the end of the 2.2-mile stretch, hydraulic jacks elevate the curbs eight inches above the ground, or cause retract-

Top, retractable curbs being installed on Chicago's lake shore drive; below, a glimpse of retracting springs under curb

ing springs to lower them flush with the pavement. Lowering the entire length of curb takes only ten to twenty seconds.

X853 Highway Traps of Wire Coils Entangle Armored Cars



Coils of wire are placed on English roads to impede invasion

One simple defense against mechanized troops is to place coils of wire in the path of the trucks and armored cars. Although not impressive, these light coils entwine themselves around any car that has exposed axles and snarl it helplessly just as a rope stops the propeller of a motorboat. The British army used the wire coils liberally, particularly along narrow country roads, in preparing against invasion.

FIGHTING FOREST FIRES

Conf. Karl Stoffel, Wenatchee, Wash.



Above, dressing two parachutists for a jump from the specially built monoplane. At right, parachute mantles a tree as the jumper lands in Chelan National Forest. Below, guiding a parachute down within seventy feet of target



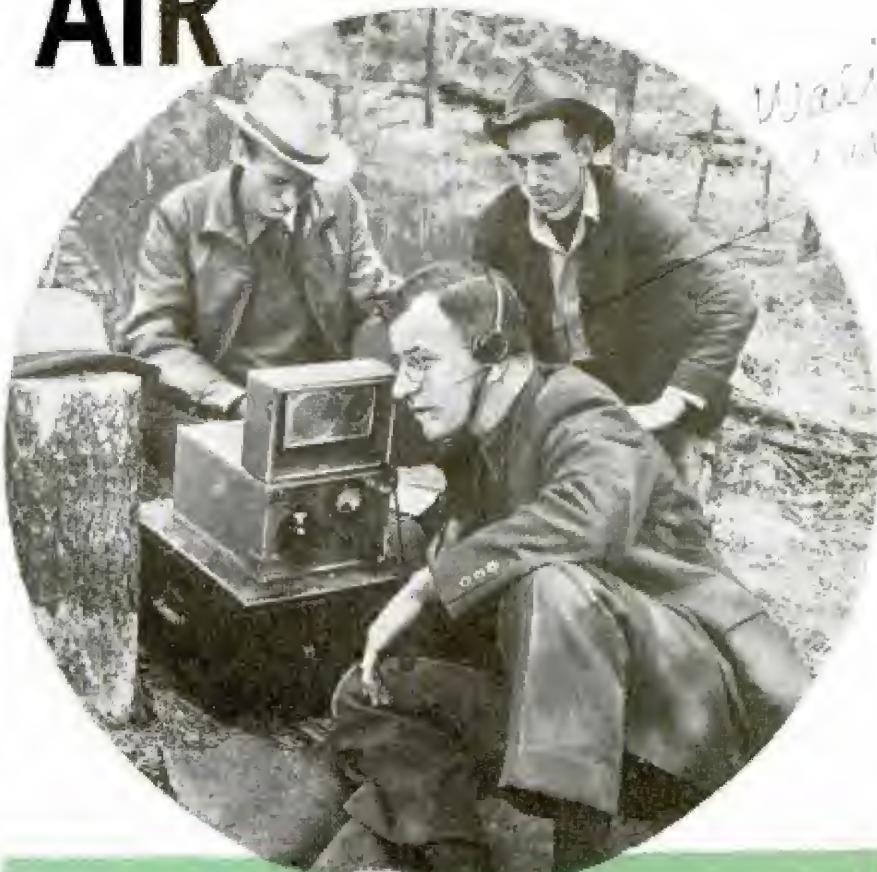
FIRE-FIGHTING forces of Uncle Sam's Forest Service have been streamlined in an effort to reduce losses, such as the 1939 toll of 36,353 acres in the high mountain country of the Northwest Region No. 1 of national forests.

Perhaps the greatest single advancement in control work has been the inauguration of parachute squads. Men, specially trained and equipped, drop from the sky directly on the fire line, within minutes after look-outs have turned in the smoke report.

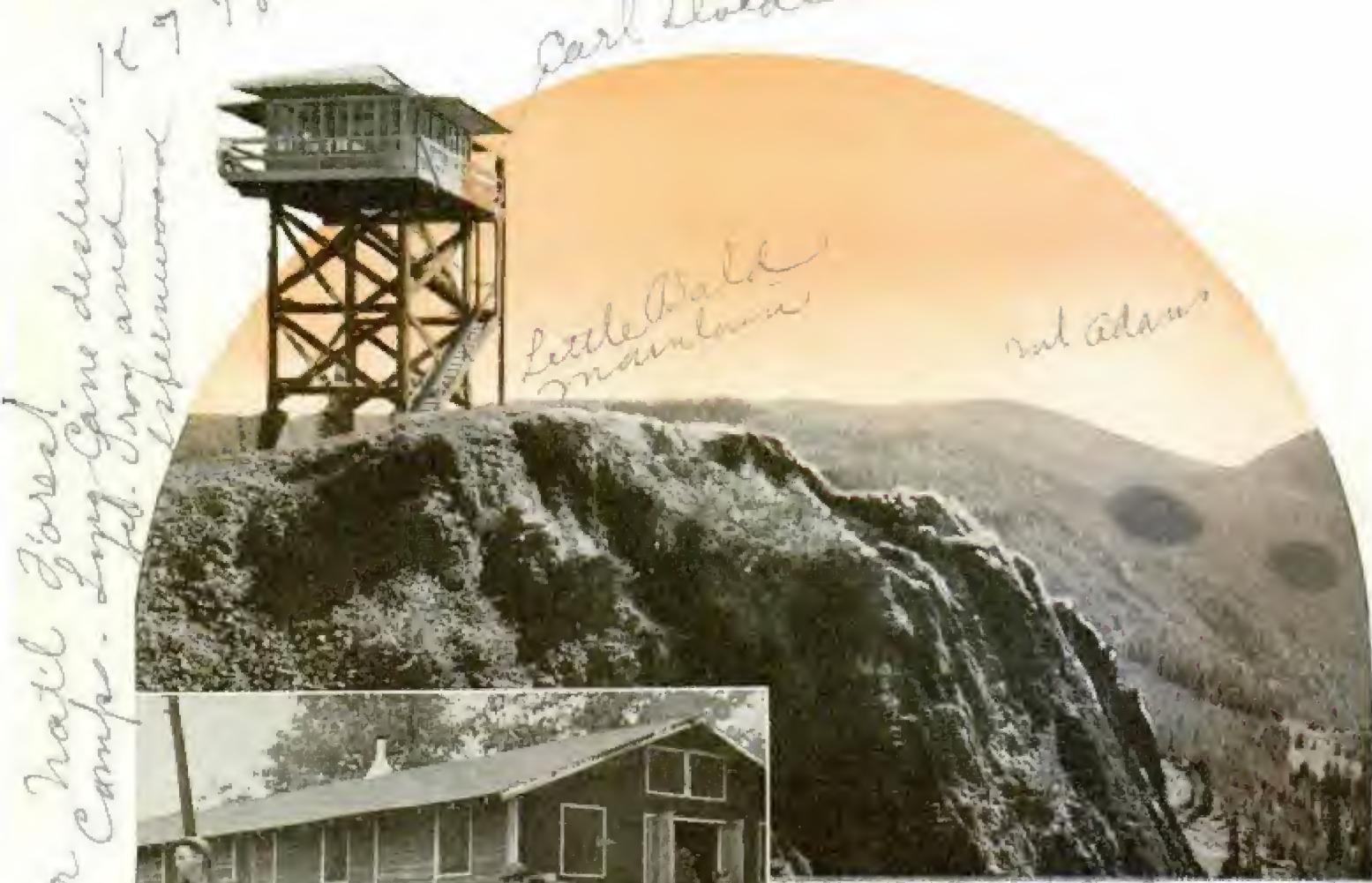
Parachuting was tried out experimentally last fall in the Chelan Forest near Wenatchee, Wash. A professional jumper, Frank Derry, was hired for the experiments. He was dressed in a padded suit, with football helmet, high leather collar and wire-mesh face protector. He wore a quick-opening parachute and an emergency army 'chute.

from the AIR

On his first jump Derry floated down gently, only to get hopelessly tangled in the tree tops. Once rescued, he had plenty of suggestions. The 'chute worked fine. It opened quickly and he was able to guide himself directly over the target. But the suit was too tight, cumbersome and binding. So the suit was revamped. The one now in use is of two-piece duck. The jacket, closely belted above the hips, has a zipper opening from top to bottom. The trousers, reaching high above the natural waistline and fitting snugly over the jacket, zip open from waistband to feet. In one trouser leg is a large pocket, to hold a lowering rope. Both garments are padded with thick wool felt over vulnerable spots, in the manner of a football suit. The collar is padded



Top, ranger gets radio report from parachute jumper who has just landed at forest fire. Below, right, jumpers are protected for rough landings; left, crossed strings on dispatcher's map show location of fire



Above, fire-control lookout in Snoqualmie National Forest. Left, the fire-fighting squad snaps into action and is on its way before the alarm bell stops clanging. Below, at field headquarters the proper tools are speedily handed out to the men and no time is lost in getting at the blaze.



Winter Watch
E.C.C. Camps
Long Cane Creek
Spinewood

and sufficiently flexible so the jumper can bend his head forward or backward, for better visibility. The 'chute harness permits the jumper to detach himself from the 'chute and reach the ground by a rope.

When the testing was finished, Derry instructed a group of experienced fire guards and rangers in the jumping technique. Early this summer, these men in turn conducted jumping schools in regional forests.

The smoke-jumping procedure is fairly simple. The pilot flies across the spot of smoke and releases a ten-pound bag of sand to which a small 'chute is attached. The plane circles and the men watch the action of the wind and air currents on the test 'chute. Then, approaching the mark for the second time, the pilot makes correction for wind drift before signaling the jumper to let go. Planes are equipped with special steps and handholds to enable jumpers to get into the air properly.

Then the pilot circles again and drops a

burlap 'chute with fire-fighting tools, lamp, two days' rations, first-aid kit, water canteen and small articles. The smoke jumper spots these supplies coming down by attached streamers and makes his way to the pack as soon as he has climbed out of his suit. He is then ready to go to the fire, put it out if it is not too large or report by radio if he needs help. He carries a ten-pound portable radio set.



Although new and spectacular, and highly advantageous in many respects, smoke jumping has supplemented rather than replaced standard methods of fighting fire. Important for all purposes is the general use of short-wave radio sending and receiving sets. Scouting units are now organized and may be sent to the fire line ahead of the fighters. In a matter of minutes after their arrival they start making reports. At headquarters, is a draftsman with a map. As reports come in from the fire line, he draws a scale map of the action and the fire chief is able to deploy his men to the best advantage. Line scouts report on wind, condition of the forest, speed of the fire and progress of the battle. The man in charge of a big fire can get a much better picture of a big blaze now in an hour than he could have gotten with-



Top, CCC boy weights down "X" marker after starting smudge to attract pilot's attention. Right, jumper wearing experimental suit and carrying supplies for fighting remote fire.

Bottom, building a fire line

out the radio in many hours or even days.

In every forest headquarters today are assembled complete fire-fighting outfits, called smoke-chaser units. Light and compact but with all the essentials, these units are stowed in packs with a total weight of only thirty-two pounds.

There are one-man, two-man, eight-man or forty-man units. The packs contain the regulation combination ax and hoe, a shovel, emergency rations for two days, flash lamp, first-aid kit, water canteen and one double-action hand pump with a five-gallon collapsible rubber bag.

Food in the packs, canned and condensed, is for use by smoke chasers on small fires

(Continued to page 150A)

'Airmobile' Turns Around at a Mile a Minute



Free Lance Photo Isuill

Independent braking on the two forward wheels permits the operator to swing this "airmobile" in a circle at high speed. The car is used in a carnival performance; its owner says it will do 140 miles an hour.

Twice the length of an ordinary automobile, a three-wheel car that looks more like an airplane than a highway vehicle is causing a sensation on western roads. The Oklahoma built "airmobile" can make a complete reversal of direction at sixty miles an hour, turning in its own length and starting in the opposite direction. There are independent brakes on the two front drive wheels, and when one is braked the single tail wheel swings around in a circle with the braked wheel as a pivot.

The cockpit, too, resembles that of an airplane. The steering wheel operates both the rear wheel and the rudder, which, along with the tail and its stabilizers, required precision construction to prevent any wobbling in the air stream. The builder claims a speed of 140 miles an hour and says the streamlining helps obtain 41.2 miles per gallon of gas. The car has been appearing in a carnival fire act, plunging through a seventy-five foot circle of fire formed by lighting oil-soaked straw.

Garment Bag in Top of Automobile Folds Out of the Way

None of the used space in the automobile is taken up by a garment bag now on the market that folds flat against the top, where it remains out of the way until

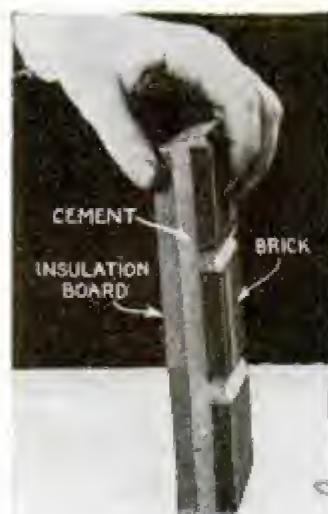
wanted. The frame that holds the bag fastens flush against the ceiling by spring clips and may be adjusted to fit cars of any width. Clothing is carried in the bag without getting wrinkled or dusty.



Top, bag folded; bottom, easy to reach when unfolded

Insulation Sealed to Brick Veneer to Form a Solid Slab

Brick veneer or stone bonded by waterproof portland cement mortar to a half-inch layer of a fiber insulating board forms a new building material. Brick of standard width and length is used, but only one-half inch thick. With its insulating back and



the quarter-inch bond of mortar the slab is one and one-fourth inch thick, three bricks high and three bricks long. These slabs fasten to the sheathing, but rest on the existing foundation which need not be built out. The panels are bonded in a mold under light pressure and in fifteen minutes can be removed for curing.

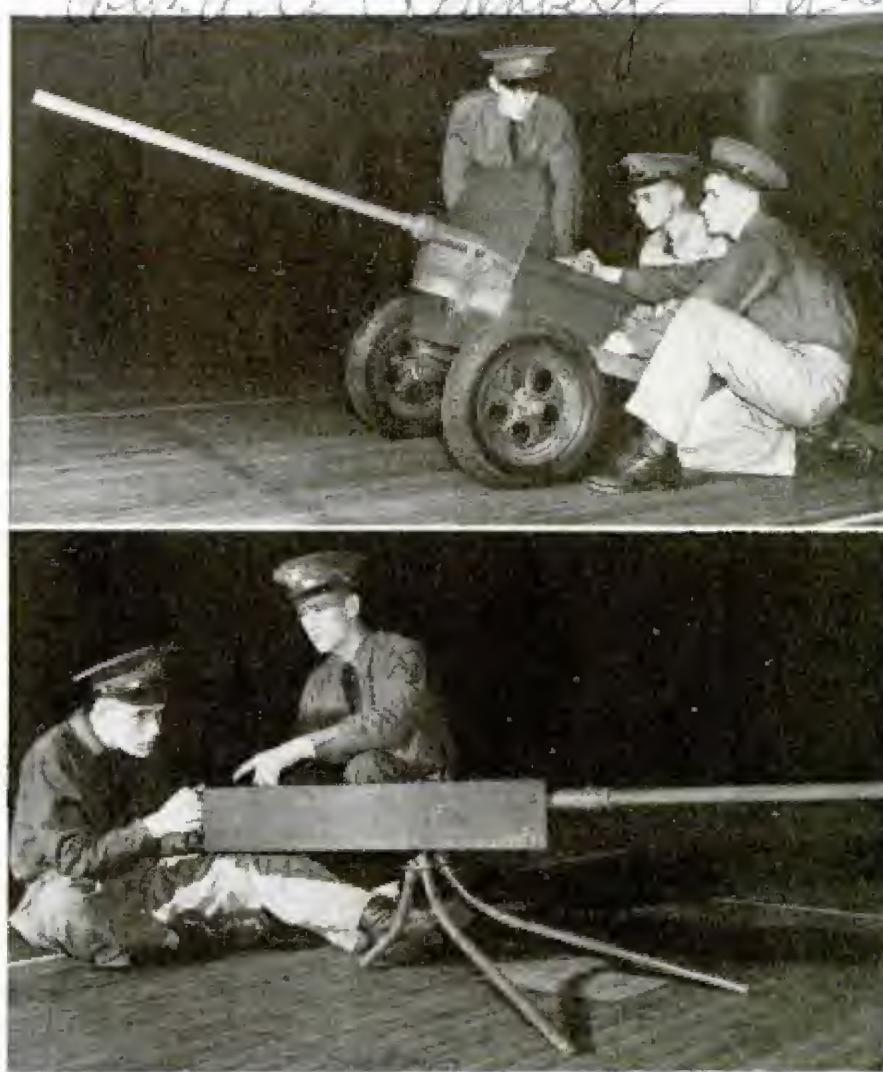
922
**Motorcycle Taxicab
Latest 'Rickshaw'
for Shanghai**

Time-honored rickshaws on the streets of Shanghai, China, have a new competitor in the form of an ordinary motorcycle with sidecar attached, capable of carrying two passengers. The vehicle is enclosed in a steel body, and the driver, riding on the motorcycle seat, operates and steers the machine in the usual way. Luggage is stored in a compartment at the rear. The high price of gasoline in China makes ordinary taxicab business next to impossible, but the new motorcycle unit sidesteps this economic handicap.



New taxicab for streets of Shanghai is this motorcycle and sidecar enclosed in steel body that can carry two passengers

Dummy Guns Train Soldiers for Handling Real Weapons



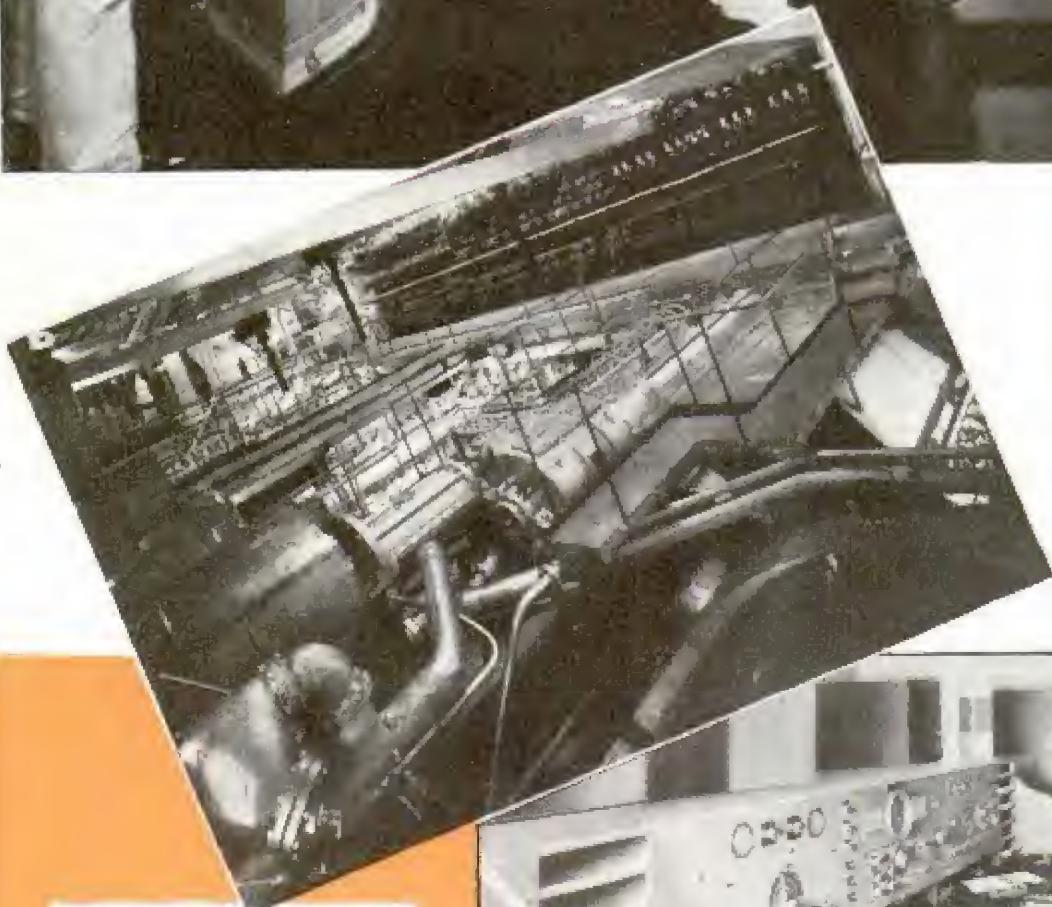
At top is a copy of the thirty-seven millimeter anti-tank gun; below, a guardsman practices with a dummy fifty-caliber machine gun

For want of enough real arms to train the expanding army, the 71st National Guard regiment gives its recruits preliminary training with dummy guns. One is an imitation of the fifty-caliber machine gun, made of wood and pipes; another, mounted on a rubber-tired truck, is a copy of a thirty-seven-millimeter anti-tank gun. Since the guns don't fire, the soldiers are simply taught their theoretical use in maneuvers. Real weapons will replace the dummy guns as fast as they can be produced.

Boliden & Söderberg
A Swedish mining firm has produced an arsenic compound for impregnating timber to make it proof against rot or insect attack; the treated wood is slightly green in color, tinged with brown, and does not require painting.

R 962 United States Lines
Cline Broadway New York

AMERICA'S



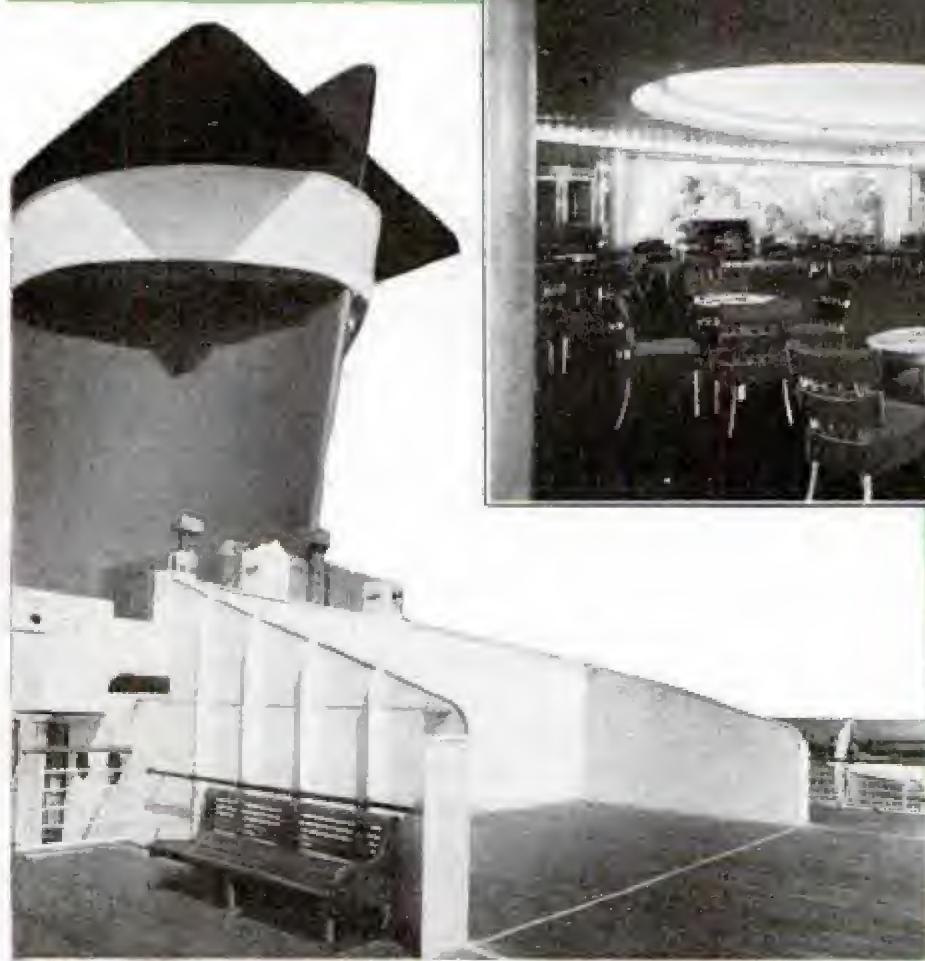
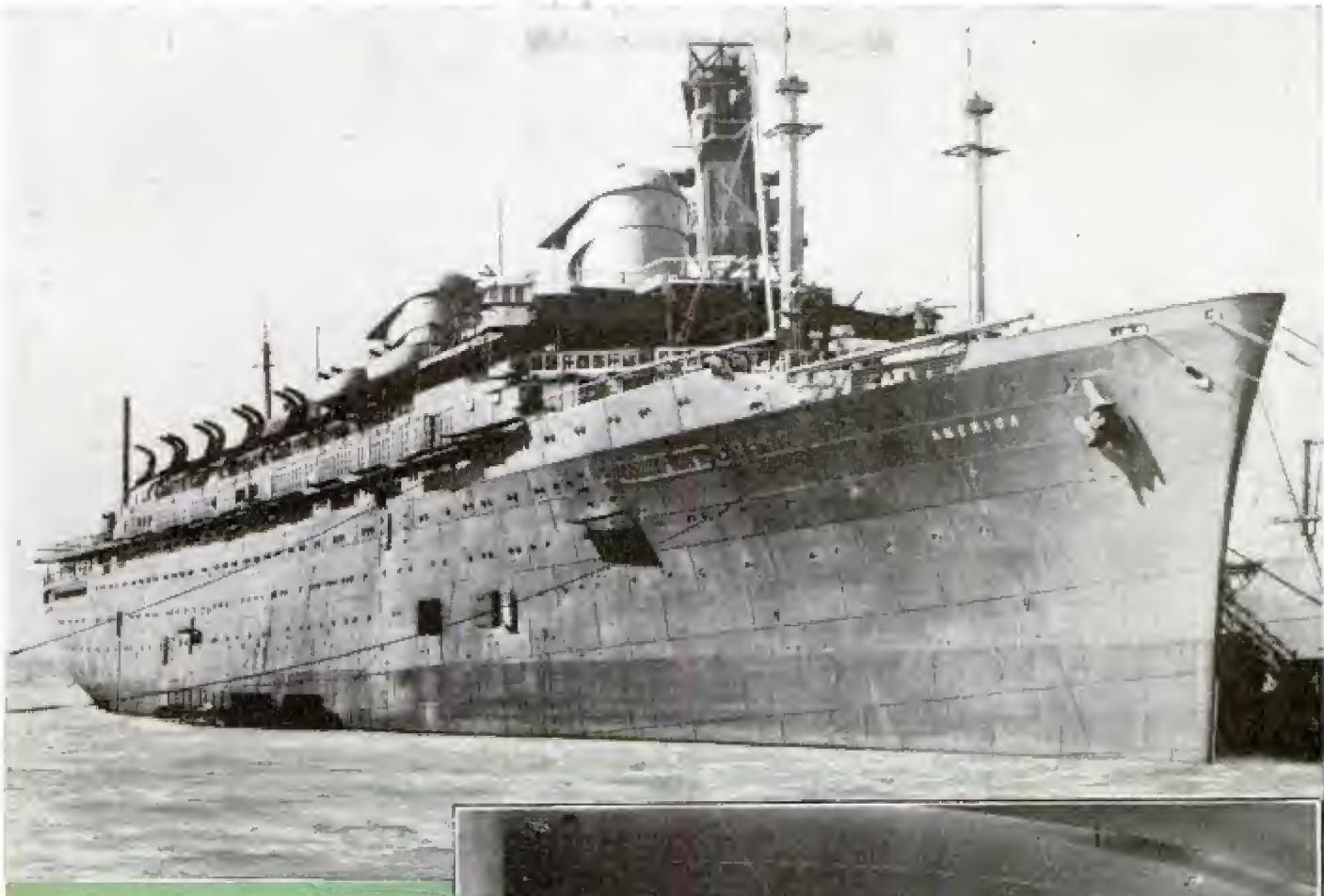
The main radio room of the "America" (right) has five transmitters and receivers, four of them for radiotelegraphy and one for telephony, and a radio auto alarm



On the navigation bridge of the S.S. "America," above, is the radio compass with which the liner's position can be determined. At left is the engine room and main switchboard. The ship's two sets of triple expansion turbines develop 34,000 shaft horsepower at 128 revolutions per minute, giving her a twenty-three knot speed.

R 963

BIGGEST LINER



Pride of the American merchant fleet, the U. S. liner "America" is 723 feet long, with 92-foot beam, accommodating 1,219 passengers and crew of 639. Above, the grand ballroom, with silver leaf on ceiling and columns. Left, handball court. Projections on funnels keep soot from falling on deck

K907

130-Pound Airplane Engine Delivers 75 Horsepower



One man carries lightweight engine capable of flying two-passenger plane. Note arrangement of cylinders.

Light enough to be picked up by a mechanic, yet supplying power to fly a plane carrying two passengers, an engine built by a California-inventor develops seventy-five horsepower and weighs only 130 pounds. Of the double-opposed type, the engine includes a built-up roller-bearing crankshaft created by the same inventor.

K947

Stretcher on a Bicycle Wheel Speeds War Rescue Work

Air-raid defense officers in an English city developed a mono-wheel stretcher to facilitate rescue work in wartime disasters. The standard steel stretcher is mounted on



Since one man can handle this mono-wheel stretcher, the rescue squad can work twice as fast.

1816 Statler Hotel 34
a single bicycle wheel, which can be handled by one man with ease, permitting the rescue squad to do twice as much work.

K963

Buffalo, N.Y. Water in Gasoline Tank Detected by Paste on Fuel Gauge

Water in the gasoline or fuel oil tank can be detected easily by a simple test with a gauge stick that changes color in the presence of moisture. The stick is covered with a thin layer of a chemical paste which is available in tubes. The paste is pink, but when thrust to the bottom of the fuel tank, any water there will turn it white.

K839

Geared Tool for Wheel Wrench Simplifies Truck Servicing



How the geared tool is used with regular wrench for removing a dual wheel

Offering power and smooth operation, an adapter for the wheel wrench has a three-to-one gear ratio which speeds up truck servicing by quickly removing or replacing wheel nuts. Even the most tightly locked outer wheel nuts on dual wheel jobs may be loosened easily without damage to inner wheel nuts, studs or wheel parts. The tool is used with a regular wheel wrench and can be handled efficiently by one man on jobs that otherwise might tax the strength of two men.

The 1941 CARS



657

Pontiac



Plymouth

ABOVE, one of the Torpedo Fleet, a two-tone sedan whose beauty is caught by the camera in full natural color. Left, another two-tone beauty, the Plymouth Special Deluxe. Note unusual design of bumper, as well as the front-end treatment by which appearance of great strength is achieved





Ford

658

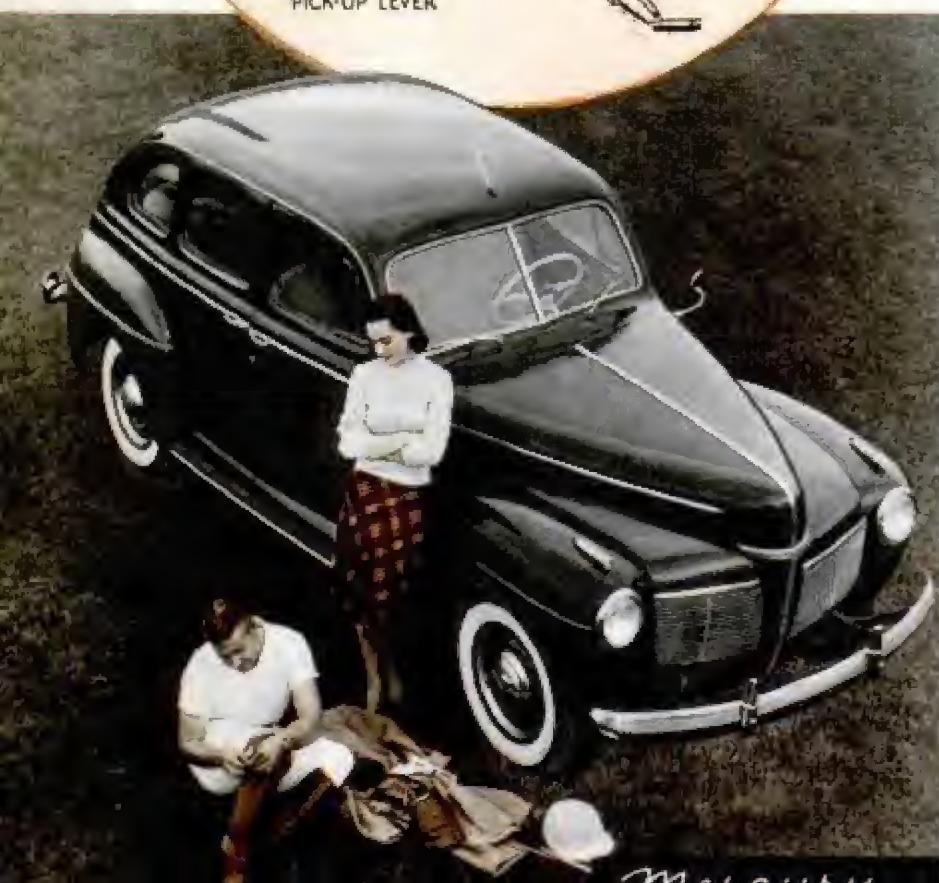
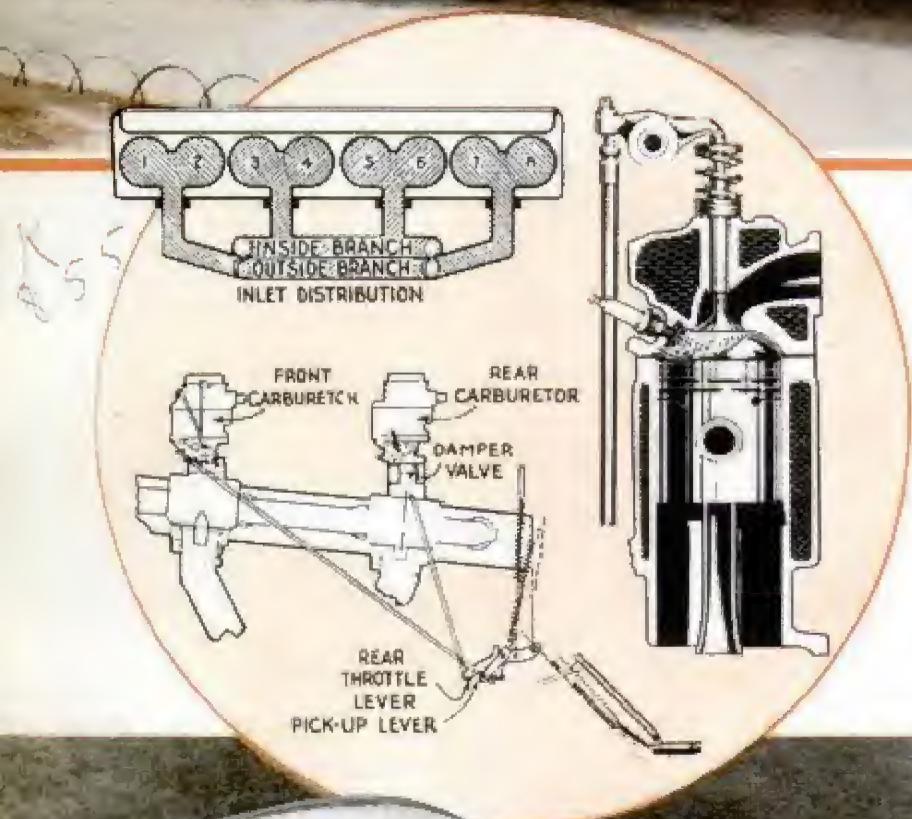
By Julian Leggett

MORE miles per gallon, flashier performance, roomier and lower bodies on longer wheelbases and exterior colors that promise to convert America's highways into kaleidoscopic ribbons are features of 1941-model automobiles revealed in a comparison with last year's cars.

New entries in the low-price field include the Nash "600," with an economy rating of twenty-five to thirty miles per gallon of gasoline, and the equally thrifty "Americar," smartly styled successor to the Willys.

Buick introduces compound carburetion, a development designed to achieve unusual economy in an automobile of that weight without sacrificing performance. It consists of two dual carburetors mounted on the engine to provide better mixture ratios of air to gasoline; the Series 40, smallest of the line, gets slightly more than

TOP, Ford Super-Deluxe Tudor with 114-inch wheelbase. Center, sketch of Buick compound carburetion (left) and ball combustion design (right). Below, Mercury sedan with body so wide it partly conceals running boards



May 1941



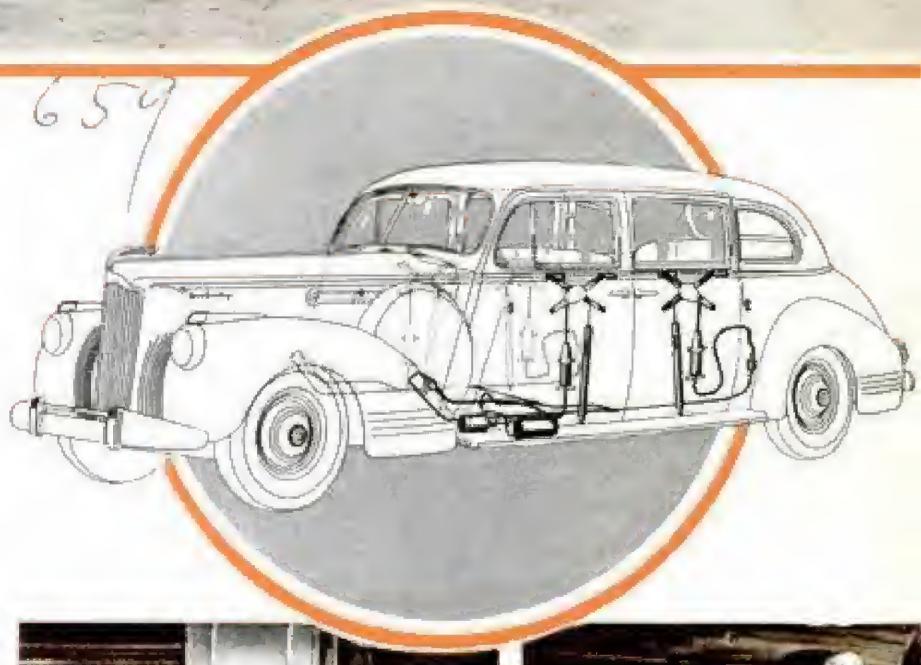
Chevrolet

1857

twenty miles per gallon when equipped with it and the larger models, on which it is standard equipment, are proportionately frugal. For so-called full-throttle operation, in high gear, the system works like this: below fifteen miles per hour, the front carburetor's main fuel system is functioning, the rear one is not; fifteen to twenty miles per hour, the front carburetor's main system is working and the rear one is just beginning to feed gasoline; thirty-five to forty, both carburetor main systems working. Hill-climbing, acceleration and top speed are said to be far superior when compound carburetion is employed. Hand-in-hand with this development is the reshaping of Buick engine combustion chambers so that the fuel charge is compressed into a ball around the spark plug, affording improved combustion and sharply reducing detonation ("pinging") tendencies.

With compound carburetion, the 115-horsepower Buick 40 engine develops 125 horsepower; the larger motor, which has the carburetion system at no extra cost, 165 horsepower. This is a considerable increase

659



AT TOP is the longer, higher-powered Chevrolet in the sedan model. Circle, sketch revealing Packard's hydraulic automatic window lift. Windows are raised or lowered by this mechanism by touching a button in rear or front compartments (bottom)



Studebaker



660

in power over last year's engines and
is characteristic of the industry.

Chevrolet, for instance, has stepped from eighty-five to ninety horsepower, accompanying it with an increase of three inches in wheel-base, to 116 inches. The Chevrolet body has been widened and made more massive looking; running boards have been replaced by convenient rubber-ribbed safety steps concealed by the skirt of each door and in most models, concealed hinges are used. The Chevrolet is marked by advances in streamlining—"valleys" between hood and front fenders are eliminated; windows, rear windows and upper portion of the sides are increased in slope, and the whole body is set lower. Arrangement is made for attaching the front license plate to the center of the

STUDEBAKER sedan, in two-tone finish (top), the Nash (center) and Chrysler (below), all depicted in their full beauty by color film. The Nash 600 is styled identically with the sedan pictured above





Buick

661 K855

bumper, with a steel guard underneath to protect it from flying gravel.

Plymouth, too, increases horsepower to eighty-seven, and has a wheelbase of 117 inches. A mechanical innovation is the "get away gear," which permits starting in second-gear position under virtually all conditions. First or low gear is utilized only for uphill starts or pulling out of mud or sand. Plymouth also has a new safety rim wheel, common to all Chrysler built automobiles this year, which prevents a flat tire from coming off the wheel, even at high speeds. With this new rim, a completely flat tire gives the same performance as a tire inflated to ten pounds of air pressure on the standard wheel. Thus, the new rim serves the double purpose of holding the flat tire on the rim and of providing sufficient traction to aid in



De Soto

TOP, the Sedanet, a six-passenger, two-door sedan with sharply sloping back. Center, head on view of De Soto sedan. Both cars are in natural colors.

Below, the Super-Six in two-tone finish

Hudson





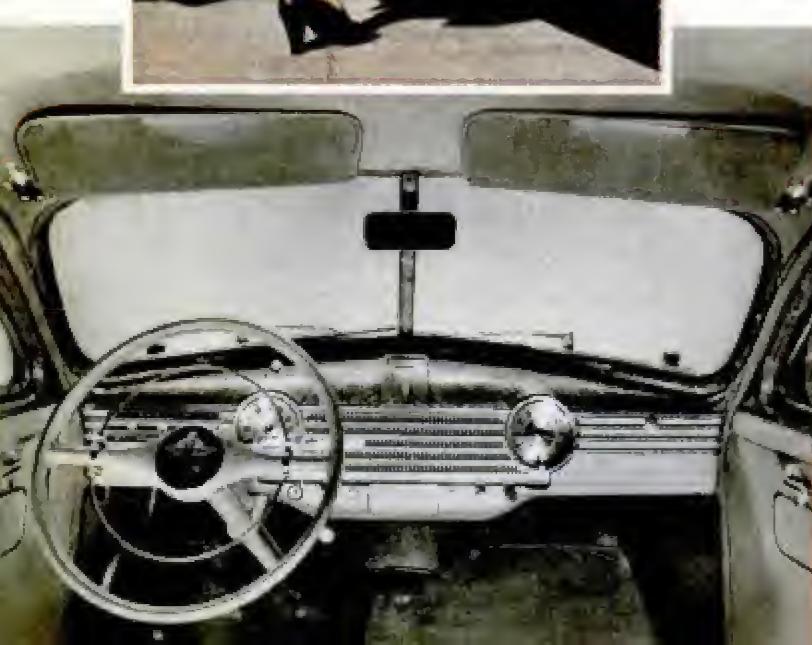
Dodge

662

stopping the car safely in case of blowouts. Another all-Chrysler feature is the safety speedometer which has a translucent indicator that shows green at speeds up to thirty miles an hour, amber up to fifty and red above fifty. New high-duty bearings, another Chrysler feature, give three to five times longer bearing life than the bearings they replaced and dissipate heat more rapidly. The Plymouth battery has a special device that shows when the proper amount of water has been put in, the fluid apparently changing color when the proper level is reached.

So satisfactory was the public's reception of the "torpedo" design, Pontiac introduces an entire torpedo fleet, the smallest with a ninety-horsepower six-cylinder engine and 119-inch

SPECIALLY equipped Dodge two-door brougham (top); running board of Pontiac and other General Motors cars is concealed by flared skirt of door (center); smart instrument panel of Chevrolet (bottom, left) and Dodge front end (bottom, right) with gravel deflector and special bumper guards





Lincoln Zephyr

KP53

wheelbase and the largest with a 105-horsepower eight-cylinder engine and 122-inch wheelbase. Feature model of the line is a Streamliner with unbroken line from roof to rear bumper. This design, a Fisher Body development, is carried into other General Motors cars. Running boards are replaced by individual door steps which are enclosed and concealed by a flare in the lower edge of the doors. A new-type door hinge holds the door in position when fully open, preventing accidental closing. A two-spoke steering wheel has horn-operating keys set into the spokes. Automatic lighting of the Pontiac's interior is provided. When either front door is opened, a switch located on the rear edge of the door pillars turns on the dome light. The oil cleaner is built in, being located at the inlet to the oil line in the crankcase where all oil must pass on the way to bearings and working parts. A settling chamber built around the inlet to the oil system, a rounded chamber at the top of the inlet tube, and a flat

663



TOP, a sedan model with beautiful lines. Right, two-spoke steering wheel featured by Dodge. Note instrument visibility. Below, left, Hudson's ventilator sidetracks water into rear of motor compartment. Right, Willys under a new name—Americar

Americar (Willys)





baffle reverse the flow of oil and cause dirt particles to be thrown out and into the settling chamber. Thus microscopic pieces of grit are removed. Many chassis parts of the Pontiac are prelubricated and sealed so no further lubrication is needed for the life of the car under ordinary driving conditions.

A big stride toward economy and smooth operation is taken by the Chrysler Corporation in making the Fluid Drive available on all Dodge, De Soto and Chrysler models this year. Fluid Drive is an ingenious coupling, in which a light oil is used, which enables drivers to climb grades or maneuver through crowded traffic with-

(Continued on page 114A)

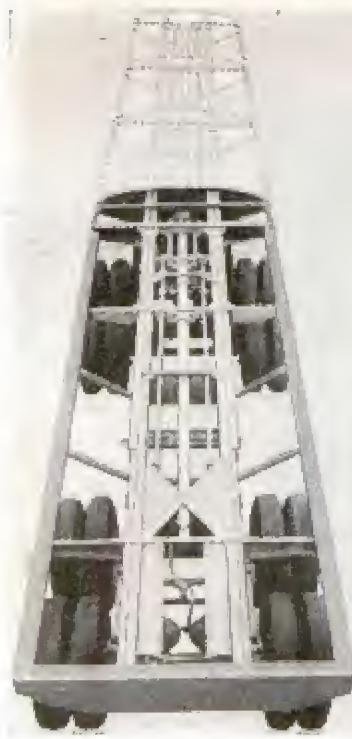
TOP, Packard two-tone 110 sedan. Center, Packard's maroon convertible. Bottom, Olds' Dynamic Cruiser. Note rear-end styling. Natural color film is the means employed to present these new cars in all their true beauty



R812. Weber Semi-Trailer

1100 25th St.

Pat. No. 2,197,740 } Los Angeles



*At the right, the semi-trailer is contracted to its shortest span to carry a compact and heavy load.
At left, the dotted lines indicate the various lengths to which it can be extended*

Four different wheel bases are available in one semi-trailer of adjustable length, permitting the operator to accommodate the trailer to any type of cargo. Fully extended, it can haul such loads as long pipes, oil-well casing or poles; retracted to its minimum length it provides correct load distribution for draw works, compressors and other short, heavy loads. The adjust-

ment of length is made quickly and easily by removing the lock pins, driving the tractor forward or backward to change the wheel base, then replacing lock pins. Telescopic joints of metal lines for air or vacuum brakes eliminate the necessity of coiling extra lengths of hose, the brake lines automatically adjusting themselves as the length of the trailer is changed.

K903 Homemade Electric Vibraphone Is Played Like a Piano

Desiring to add a vibraphone to his orchestra, but having no one to play it, one

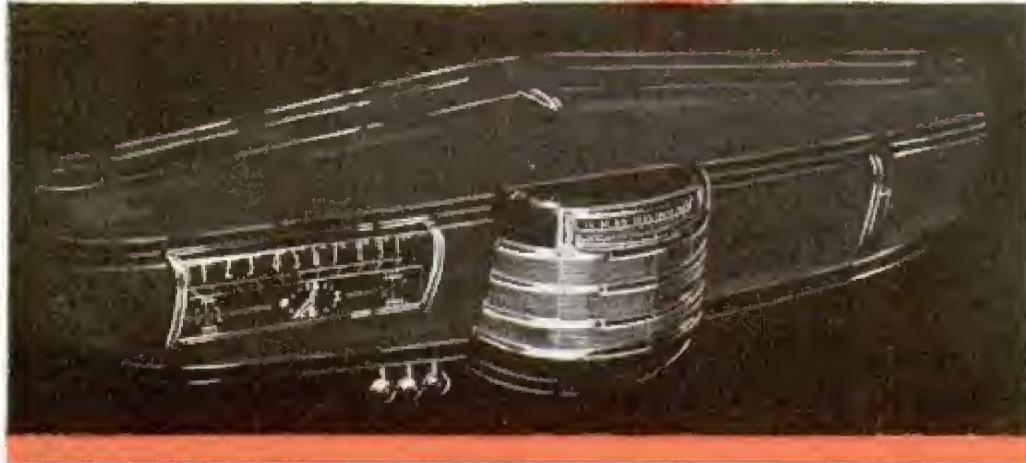


Any pianist can play this vibraphone built by orchestra leader

mechanically inclined leader built what he calls an electric vibraphone that any pianist can play. Using a vibraphone, he added electric resonators and a set of electric magnets to strike the metal bars. Keys arranged on a piano keyboard at standard height have contact points underneath which operate the magnets electrically. There are thirty keys, or two and one-half octaves. A damper on each bar, as in a piano, is released when the key is struck, remaining so as long as the key is held. The resonators may be turned on or off by separate switches controlling them. The instrument cost approximately \$600 to build, and most of the parts were made by hand.

Kill regger.

AUTOMOBILES



Above is one conception of the car of the future, drawn especially for Popular Mechanics by the author. Note its circular lounge in the rear and the wide visibility offered by its transparent plastic roof. On the cover of this issue is another special design by Mr. Walker. At left, an instrument panel with airplane-type controls

By George W. Walker

Auto Designer and Industrial Stylist

OUTSTANDINGLY different will be the motor car of the future—a future that is not far distant, as time goes.

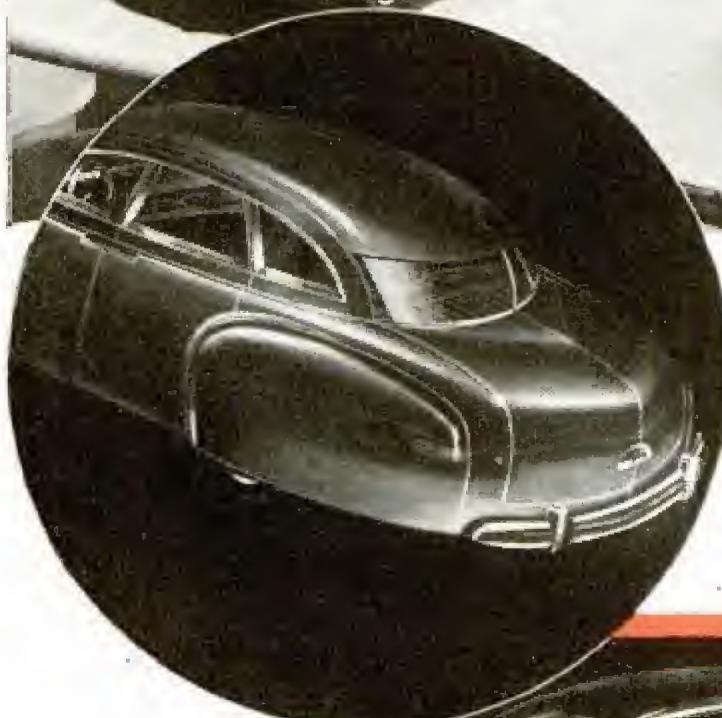
It will be an automobile carrying its engine in the rear, where the engine has belonged all along, and this placement of the power plant will make not only for far greater motoring comfort, but it will contribute materially to the unprecedented roominess of the car's interior.

It will offer entirely new concepts of comfort—"living room luxury"—with new spaciousness, radically changed seating ar-

rangements, complete summer and winter air-conditioning system, and many other innovations.

The body of the car of the future, even to its windshield and windows, will be of new synthetic materials, probably some forms of molded plastics. In this car will be found the last word in devices that will make for the safety of driver and passengers—windows and windshields of clear, transparent substances, which neither shatter nor fly under impact and thus do not cut; airplane-type "crash pads" designed right

of TOMORROW



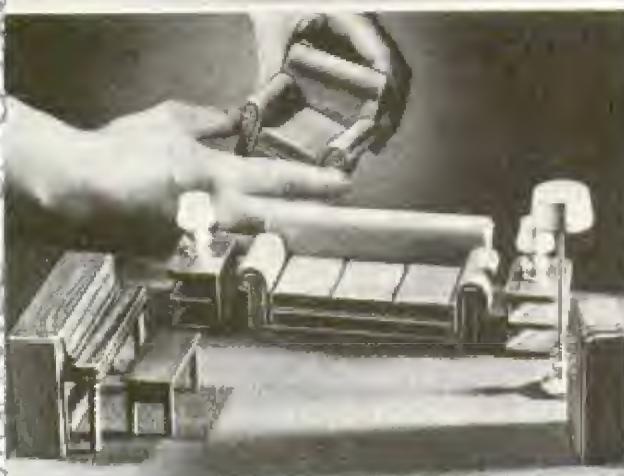
At top Mr. Walker is studying a miniature car, pointing to plastic top. His plan for a car of plastics is shown in circle; it would never need paint, and fading and chipping are impossible for color is molded right into the substance of the body. Unity of design in grille and shock-absorbing bumper are achieved in car at right

into the interior at strategic points, thus protecting occupants from hard bumps in road accidents; strong, spring-mounted bumper, running entirely around the body and an integral and pleasing part of the over-all design, capable of absorbing far more of the shattering force of collisions than bumpers do now.

(Continued to page 120A)



Doll-House Furniture in Kit Is Assembled by Buyer

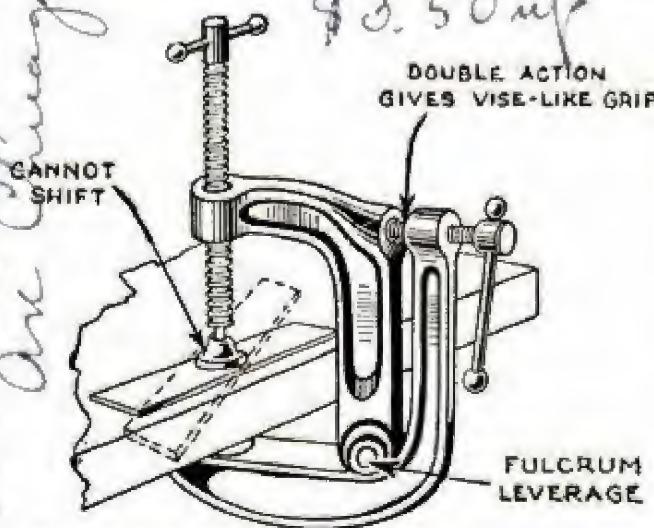


Parts for living room in ready-to-assemble kit, top; bottom, same set assembled and ready for doll house

Kits of doll-house furniture, all cut and ready to assemble, are now available for purchasers who take pride in doing their own work. Each piece may be painted by the individual to suit his taste. The complete set consists of tiny furniture for the living room, dining room, bedroom, bathroom and kitchen.

C-Clamp with Double Action Keeps Work from Slipping

Work will not shift or swing out of a double-action C-clamp that has an extra

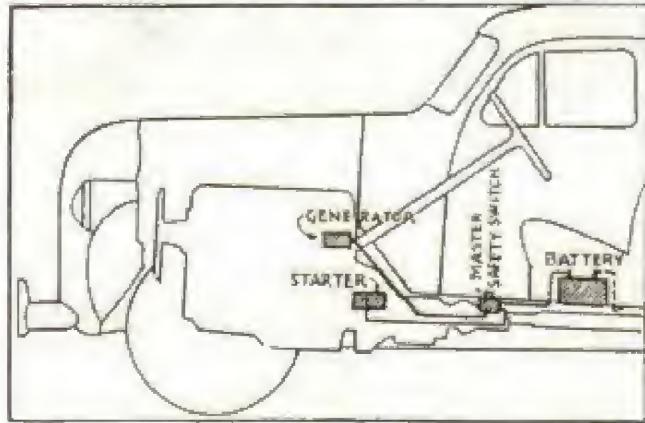


Work held in clamp does not shift when vise-like pressure is applied by horizontal screw at right

vise screw for tightening it after being set by the conventional adjustment screw. Leverage obtained by a pivoted arm increases the holding strength with no extra effort. With a few turns of the vise screw the clamp closes in a straight and firm grip without imparting any twisting motion to the jaws. It works in close quarters where lack of space prevents placing an ordinary clamp or turning the screw.

183 Auto Safety Switch Prevents Fire by Disconnecting Battery

Positive protection against fire hazards in an automobile or truck is provided by a switch that disconnects the battery and generator from the wiring circuit. Installed in the floor near the driver's feet, it is flipped on or off with a kick. In case of an



At top arrow points to "kick switch" near driver's foot; diagram, below, shows how it cuts out battery

accident, the switch shuts off automatically if the force of the impact equals that at which the mechanism has been set. A pilot light on the instrument board reminds the driver to kick the switch to "off" position when parking the car.

COUNTING IN *the* NEXT PRESIDENT



© Ewing Galloway
Behind curtains (upper right) voters mark their ballots. Bottom, a citizen operates an automatic voting machine in New York. Center, election tabulators and writers at Associated Press headquarters



By Roderick M. Grant

ON THE night of November 5 you'll turn from the dinner table to the early newspaper "extras" and the radio for the first straws showing which way the election winds are blowing. Three months of tense campaigning will be ended, with probably fifty-five million ballots cast to decide one of the keenest contests in years. A President has been elected, the balance of power in a new Congress determined.

What is the result? Officially, you won't know for weeks after election. The government has geared its machinery not much faster than a century ago when the returns trickled in to Washington by canal boat and courier, weeks later. Officially, you'll know some day, probably in December, when the House and Senate together perform the perfunctory



Top, sorting ballots after a New York election. Left, Associated Press control board for routing wire circuits to bureaus and newspapers. Below, tabulating election results at Chicago AP bureau



Jackson or James Madison, but government and business and foreign affairs would be in a nice dither in these times if the election results dragged through a long period of uncertainty.

So, some time between dinner and midnight election night, you'll buy yourself a newspaper or tune in the radio and find out the name of the next President. It's not official, but it might as well be. And, barring such a close race as that between Hughes and Wilson in 1916, when the result hung in the balance until nearly midnight Thursday, you'll probably know by midnight who's to live in the White House next January; and your morning paper will strike a balance for you between Republicans and Democrats in the next Congress.

Fifty-five million votes to count and collect from the ranchers of Arizona, from the 4,376 crowded precincts of Chicago and its suburbs,

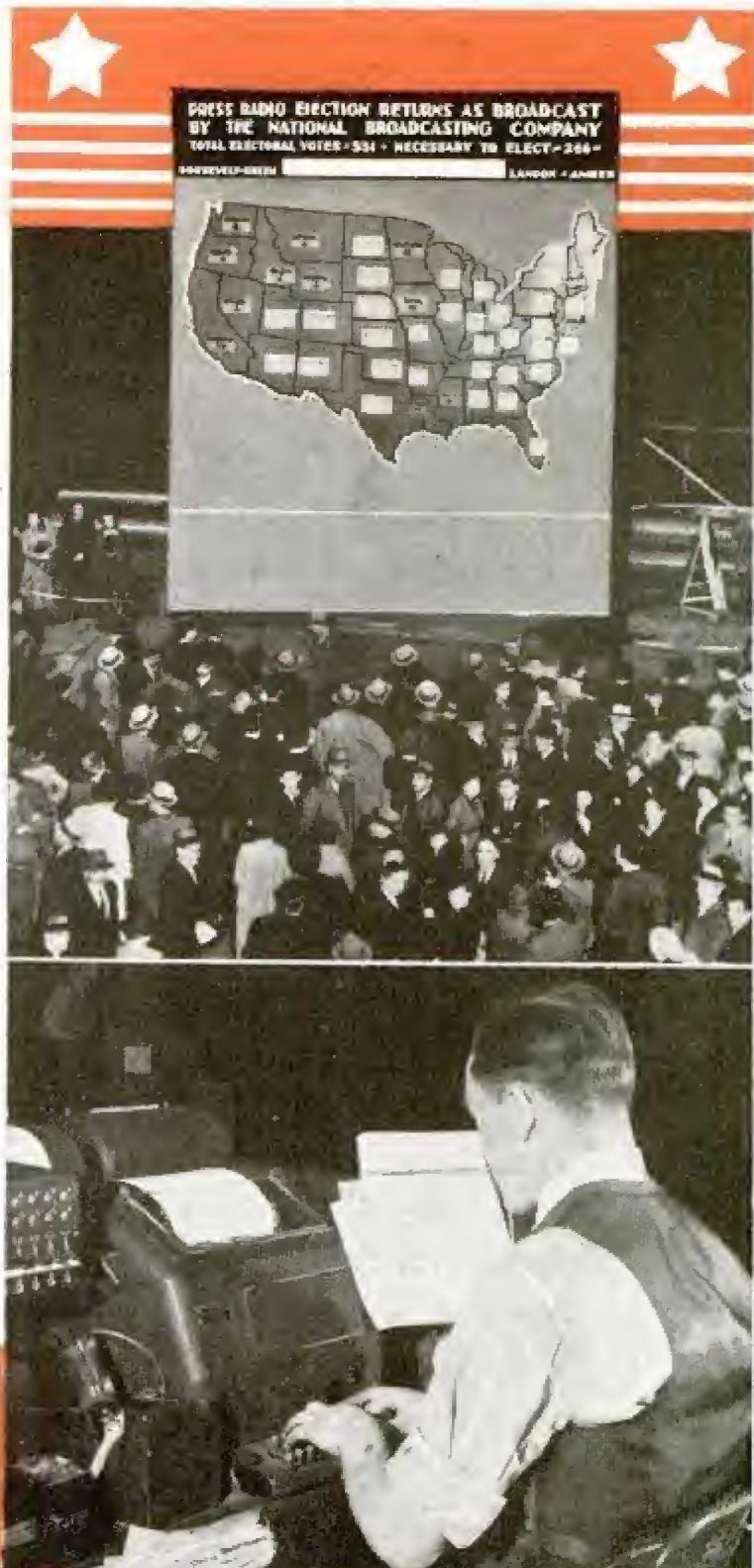
ceremony of counting the votes of the presidential electors you chose; a dignified scene, but hardly thrilling news.

Well, you can't wait for that. Perhaps they could wait in the more leisurely eighteen hundreds for the electors to choose Andrew

from the Tennessee hills and the Bad Lands of South Dakota. Who does the job, announces the vote a few hours after the polls close? Fifty thousand newspaper editors, writers, correspondents, telegraph operators, tabulators and messengers organized into an efficient, country-wide election machine by the cooperative Associated Press.

Key unit in this vast tabulating system is the precinct. As fast as the judges at any precinct polling place add up the votes for any office from state legislator to president, the total is telephoned to the county reporter for the Associated Press, who relays the figures over a leased wire to election headquarters at the principal AP bureau in the state. In the 1936 election 122,464 precinct reporters collected returns; the wires over which the figures flow election night would, in a single circuit, circle the globe nearly ten times.

Promptly at the close of the polls the count starts pouring in. From a county correspondent in Spartanburg, S. C., who may be a county clerk or a local news writer, comes a first report to AP at Columbia, S. C.: BLANK SIX SPARTANBURG COUNTY FIVE PRECINCTS LEWIS 109 JOHNSON 56. An operator at Columbia copies the figures on a



Top, crowd watching election map as returns come in at Rockefeller Center. Lower right, AP operator sends election "lead" over the printer wire. Left, a bank of telegraph printers in New York AP office

corresponding blank, representing the race for governor, state treasurer or other office. Later returns on the same race from Spartanburg county include those previously reported, and from time to time the figures from other counties are run off on adding machines to produce a county table showing the state total for any particular contest up to the minute.

Meanwhile at each state bureau an editor watches and analyzes the vote, notes a

(Continued to page 143A)

R902. *Whiteman's Way*
3060 Glendale Blvd.
**Floor Finished Like Marble
with Electric "Trowel"**



Cyrating paddles of electric "trowel" impart finish like marble to surface of newly laid concrete floor

Newly laid concrete floors are given a marblelike finish with an electric tool resembling an upside-down fan. Its three rotating trowels are said to accomplish as much as six men working by hand. With fingertip control, the machine is moved easily under its own power.

R923 —
**Hand-Type Electric Jig Saw
Makes Smooth Cut**

High cutting-speed is claimed for an electric jig saw that weighs only seventeen ounces and handles with the ease of a hand saw. The magnetic motor, mounted be-



Hand simply guides this jig saw as its magnetic motor imparts 7,200 cutting strokes a minute to blade

tween the frame and the grip, delivers 7,200 strokes per minute, and the length of the stroke can be adjusted from one-eighth to five-sixteenths of an inch. Started and stopped by a switch in the handle, the saw cuts through medium hard wood one-eighth to three-fourths of an inch thick at an average speed of twelve inches per minute and it can saw to the center of a twenty-inch panel.

R871 —
**Lightweight Aluminum Suitcase
Built for Lifetime Use**



Nine men resting their weight on a new aluminum alloy suitcase to prove its sturdiness

Luggage of "airplane metal," just introduced, offers travel cases of light weight that will last for years. These suitcases are made of strong aluminum alloy, formed in heavy dies into one-piece sides which fit together accurately. The edges are sealed in live rubber with tension catches to maintain close fits, making the case waterproof and dustproof.

1868

Clay Bank Sculptor Carves with a Pocketknife



Only the crudest tools and materials were available to this Illinois youth, yet in this clay bank near his home he has carved and molded historical and Biblical figures that have attracted wide attention

With only a pocketknife and his hands for tools, an amateur sculptor at Fieldon, Ill., is attracting attention by carving figures in a clay bank near his home. The

sculpture is the work of Floyd Harold Bull, nineteen-year-old farm boy. As a youngster he was a proficient whittler, but has never had any training in the sculptor's art.

Twelve-Shot Cylindrical Gun Fires Bomb, Gas or Flare

Fragmentation bombs, gas or smoke shells or parachute flares can be fired from a twelve-cylinder gun developed by an American manufacturer. A cylindrical

magazine which can be inserted and changed in three seconds holds the projectiles for the many-purpose weapon, which is of one and one-half inch caliber.

The gun has a 500-foot range with a four-ounce gas projectile, a 1,000-foot range with an eight-ounce projectile and fires a one-pounder up to 2,500 feet. Several guns of this type could protect an airport from parachute troops, or lay a barrage of smoke shells to hide a position. The all-purpose gun weighs only forty pounds, including its support, and it can be folded up for carrying or set up ready for action in a few seconds.



The gun and support, weighing only forty pounds, fold up quickly for carrying, and it takes but three seconds to change magazines.



SEAPLANING--



A MERICA is discovering a new sport. The thrill of flying from sparkling water instead of from dusty airports has boomed the sport of seaplane flying. Mountain lakes, inland rivers, and protected bays along the coasts are home to busy seaplane operators on pleasure and instruction flights.

Seaplaning is fun because it combines the sports of flying, powerboating, and sailing into one. Seaplanes actually make accessible many parts of the country that cannot be reached by planes that land on wheels. Small planes on floats, as well as larger amphibians and giant navy flying boats, have flown



Top, left, ready for instruction flight in seaplane. Circle, starting the engine. Below, left, doughnut lights for making seadrome. Right, Waco-ship on pontoons skims the surface

R650 Emb. Thomas & Simpson Jr. - Lexington
10442 Belton Lane



THREE SPORTS IN ONE

coast to coast many times in perfect security with a wide choice of routes. City reservoirs make good landing places if no other water is handy. Pilots have landed pontoon-equipped seaplanes on lawns and fields and flown them off again to demonstrate their adaptability.

One reason why seaplanes weren't more popular in the past was the lack of landing facilities. There were only a few private ramps and the seadromes of a few large cities. To make up for this lack the Civil Aeronautics Board and the National Youth Administration have jointly built about 300 seaplane bases at strategic spots and are still constructing additional facilities. Thirty have been built in Florida, forty in Michigan. For a small sum a city can participate in the program, the government bodies furnishing the plans and doing the work. A base costs no more than a few hundred dollars. Floats to which seaplanes can be moored and pro-



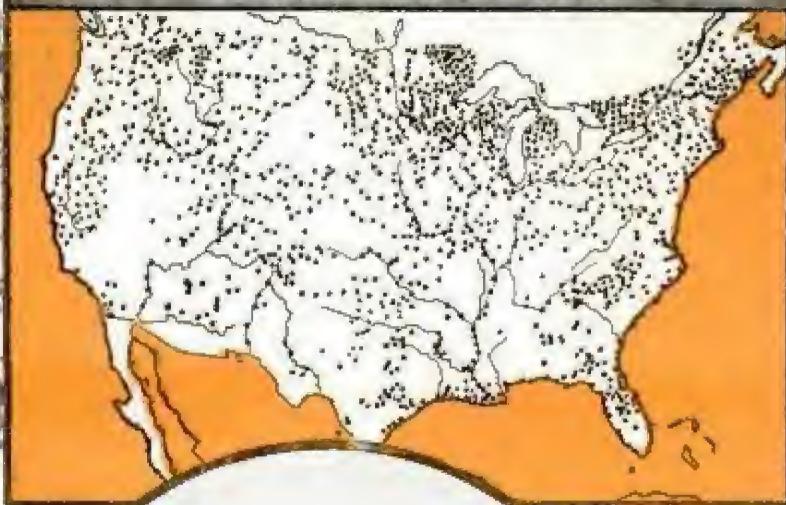
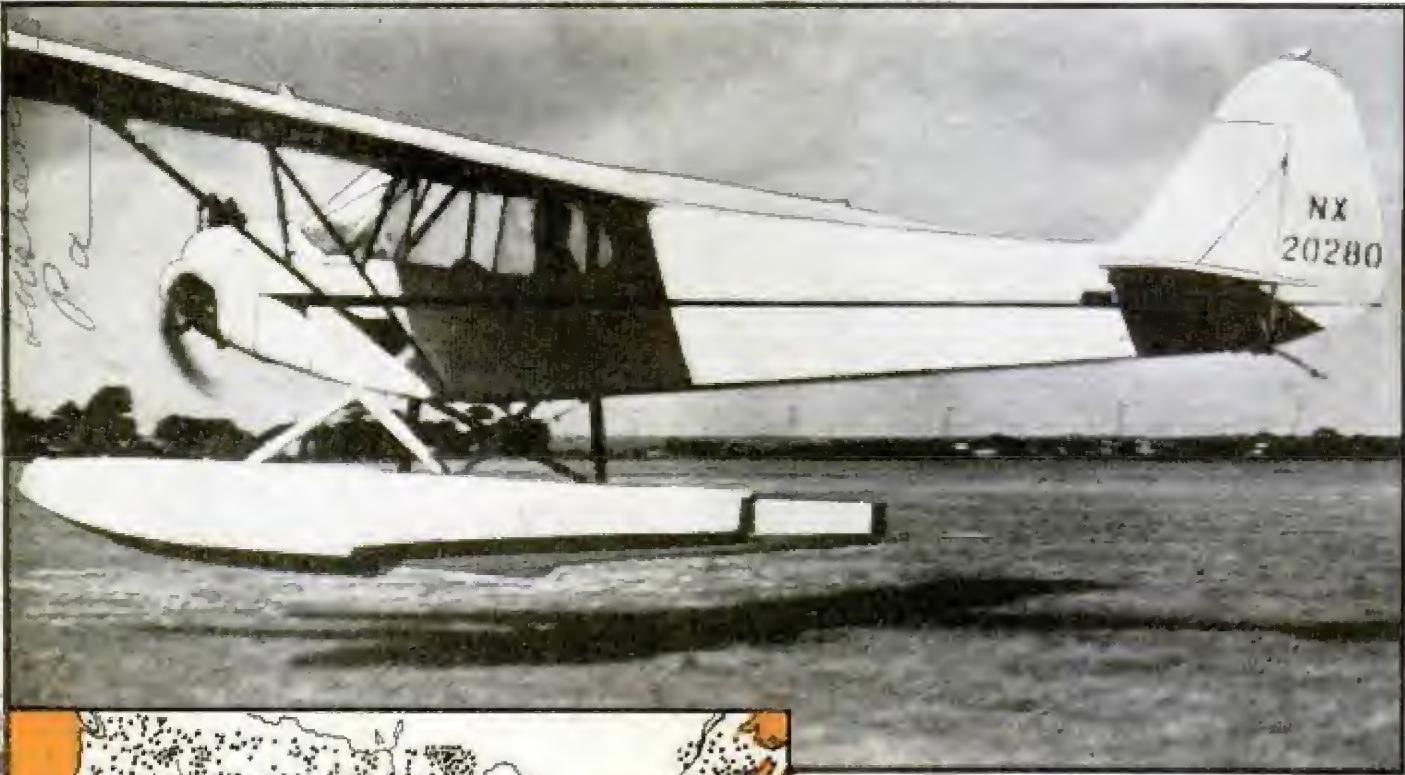
Top, Edo-float equipped plane roaring along the surface. Circle, Consolidated four-engined flying boat taking off from rough water

viding a gangway ashore are being built at some resorts, elsewhere wooden ramps are built into the water with beaching gear on wheels so seaplanes can be taken ashore.

One flier who built his own ramp at a total cost of thirty-eight dollars uses a windlass to haul his plane out of water. To

right wing aircraft
11/26/40
K650

seaplane amphibian in grass



take off, he releases the anchoring lines, starts the motor, and wiggles the tail surfaces to start the plane sliding down to the water. Other owners use automobiles to haul their planes up the ramp.

With a seaplane a pilot can fly to mountain lakes only an hour or so away by air,

Above, plane fitted with pontoons landing on grass. Left, map showing water landing spots for seaplanes. Circle, a smooth takeoff from the water

with no possible landing place for wheeled planes. Once he has landed he can taxi to a likely spot, anchor, and break out his fishing tackle. If the fish aren't biting, the chances are that another lake can be found after a short flight. For more extended trips camping gear is packed in the cabin and a canoe is lashed to the struts above one of the pontoons.

A few years ago this was a rich man's sport but now pontoons are built for many brands of light planes, including Aeroncas and Cubs. For several hundred dollars you can buy a pair of sturdy duralumin pontoons complete with struts for attaching them to the fuselage. At additional cost you can install pontoons with retractable wheels that make the plane equally at home on water or land.

One light plane manufacturer is offering a tiny flying boat, a two-place plane that lands on its hull like a China Clipper. Its seventy-five-horsepower engine has enough power to take off from lakes in high mountain country.

Metal parts of a seaplane should be "metalized" with sprayed aluminum before they are painted. Planes to be used on salt water should be provided also with stainless-steel control cables. All parts are

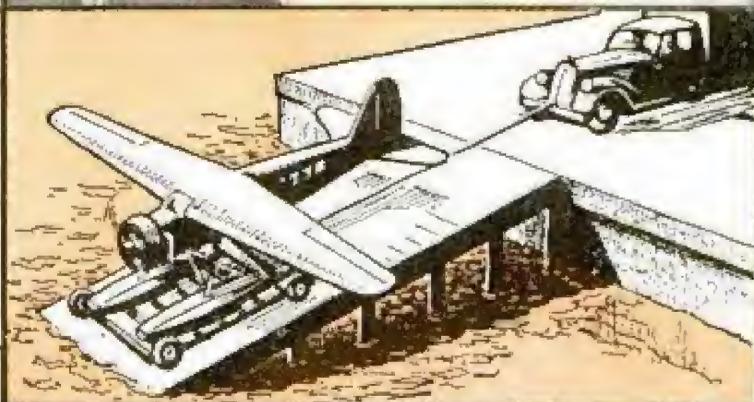


treated and kept well greased to prevent corrosion. Fabric is usually waxed and polished.

Seaplane operators say that students who learn to fly from the water are usually ready to solo sooner than those who learn on land planes. The tension of the beginner is reduced because there is less hazard in a forced landing. With more room below him the student has more confidence, and he can get in more practice landings than at a busy airport.

An airplane isn't quite as fast and doesn't climb as rapidly when

(Continued to page 141A)



Circle, pontoon-equipped plane preparing to take off from snow. Right, top, inspecting interior of pontoon for leaks. Center, drawing of one method of launching small seaplane. Bottom, plane being moored

Lightweight Trailer Welded of Stainless Steel

At left, welders are at work on the roof and wall of the stainless-steel cargo trailer, which is seen completed below. Stainless-steel bodies, built by the shotwelding process, can be made of lighter gauge metal as strong as ordinary heavy steel



From 1,500 to 5,000 pounds of weight are saved in the latest cargo trailers built of stainless steel as compared with some similar trailers of conventional steel bodies. This is because stainless steel, being stronger, can be fabricated in lighter gauges of metal than ordinary steel. The stainless steel body and roof are constructed by the shotwelding method.



Engine Built from Steam Auto Runs on 300-Foot Railway

R. S. T.
When Harold Parkinson of Smithfield, R. I., wants to visit his next door neighbor

he gets up steam in his miniature locomotive and drives over. The homemade engine, its boiler with 300 copper tubes, its cylinder and piston arrangement all salvaged from an old Stanley Steamer automobile, runs on a 300-foot railway through the yards of Mr. Parkinson and two neighbors. The owner was formerly an English railroader, and his locomotive is patterned after an English engine. It burns vaporized gasoline, runs all day on two gallons.



An erstwhile English railroad man built this locomotive for his private railway, parts of it salvaged from an old Stanley Steamer automobile

Send stamped envelope to our Bureau of Information for name of maker of any device described in this magazine.

K890 Supervisor G. S. White
Visual Aid Project (WPA)

'Planetarium' Umbrella Points Out the Stars

Amateur and student astronomers in California are learning about the skies with the help of an "umbrella planetarium." On its under side the names and outlines of the constellations are marked by embroidered colored thread, and there are buttonhole openings for the stars. When the umbrella is held up to the night sky and its Big Dipper matched with that in the sky, the handle of the umbrella points to the North Star; thus other "landmarks" in the sky can be located. The umbrella can be used as a compass. Names of stars are read with a flashlight.



Pointed to the north star, the underside of this umbrella forms a map of the skies, locating and naming the stars and constellations

Portable Room Cooling Unit Has Its Own Water Supply



The view at left shows the wall of excelsior which is kept moist to cool the air passing through it, evaporating three gallons a day

Carrying its own supply of water for evaporation, a portable air conditioner may be placed near an open window and need not be attached to the home water supply. An electric fan draws fresh air through the window and through a thin wall of excelsior which is kept moist by water pumped from its three-gallon reservoir. The water pump operates from a fan placed in the wind stream of the main electric fan.

Emergency Hose Inflates Tire with Air Transferred from the Spare

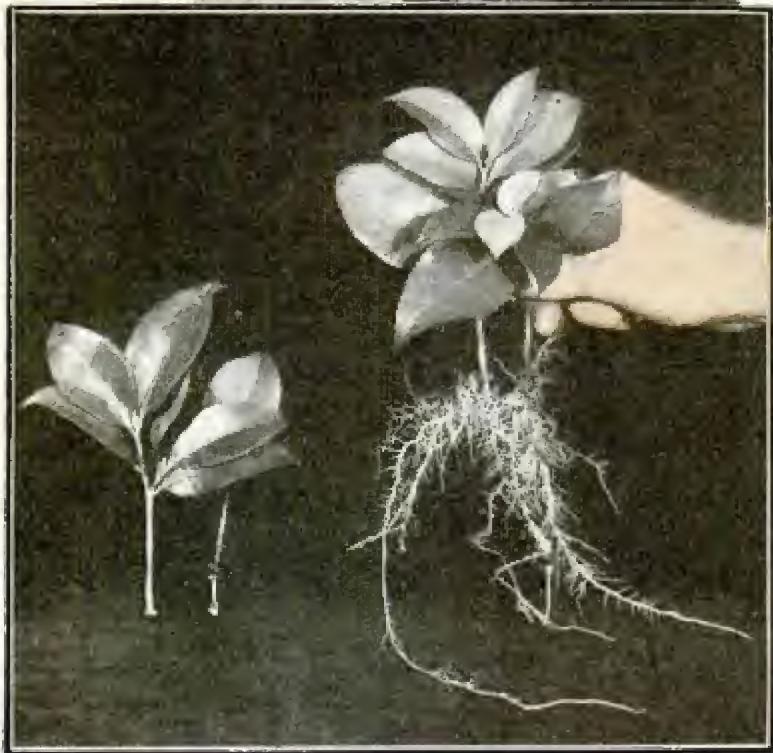
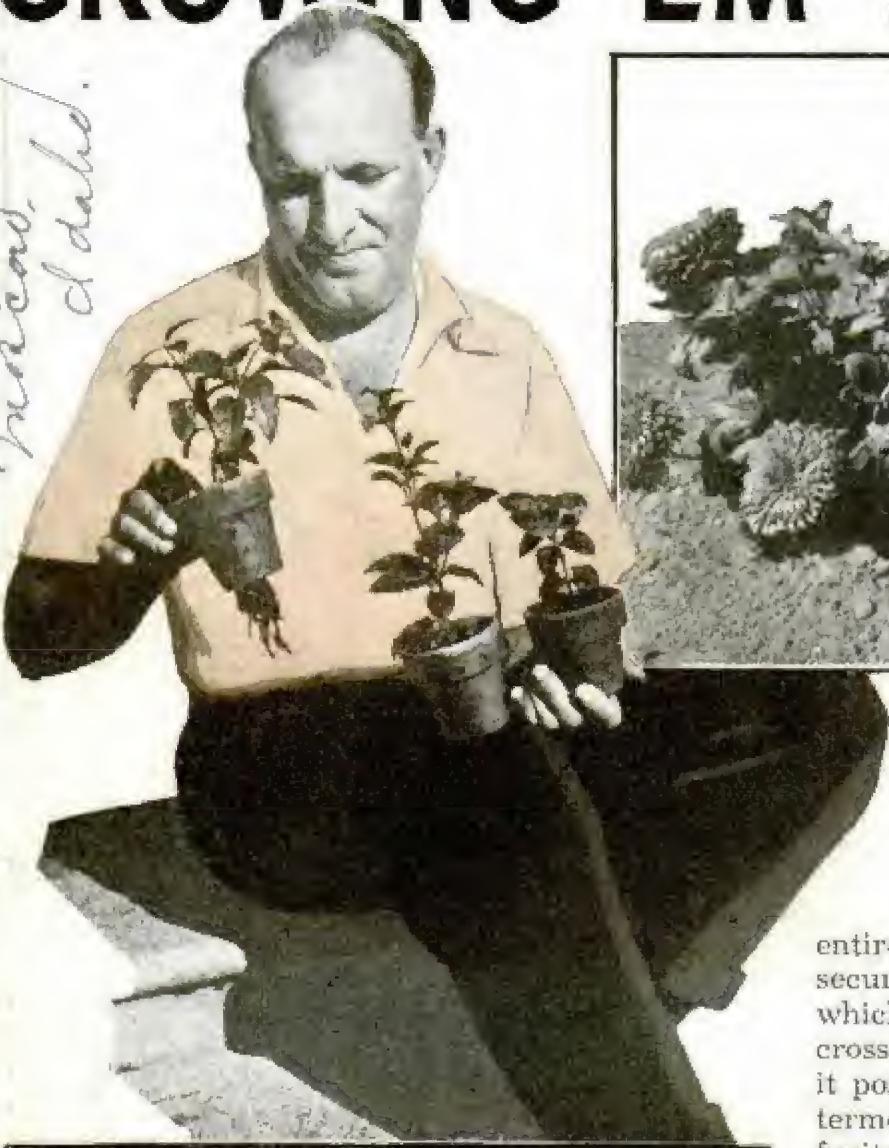
Keep the spare tire pumped up and you always have spare air on hand for emergencies. An inflation unit just brought out makes it possible to transfer enough air from the spare to inflate a flat tire in an emergency. A thumb lock connects the hose to the flat tire, and in about two minutes the tire on the car can be inflated enough for travel.



Transferring air from spare tire to a flat front

GROWING 'EM BIGGER

Cont. O. A. July general. Univ. of dahlia.
Marigold. Marigold.



Top, fuchsia plants, two treated with B-1 solution, and the small one untreated. Right, six-inch zinnias. Bottom, how synthetic hormones speed up rooting



MODERN plant engineers have found a chemical, colchicine, which completely upsets long-established laws of plant heredity. With it entirely new varieties are being secured through mating plants which in nature have been uncrossable. Other chemicals make it possible to grow seedless watermelons, tomatoes, and other fruits in which seeds are a decided nuisance.

Some chemicals speed up plant growth amazingly; others slow it down to a snail's pace. Some make plants and cuttings shoot out roots faster than Jack's beanstalk shot skyward, so that plants of enormous dimensions, veritable monstrosities, have been produced in the laboratories.

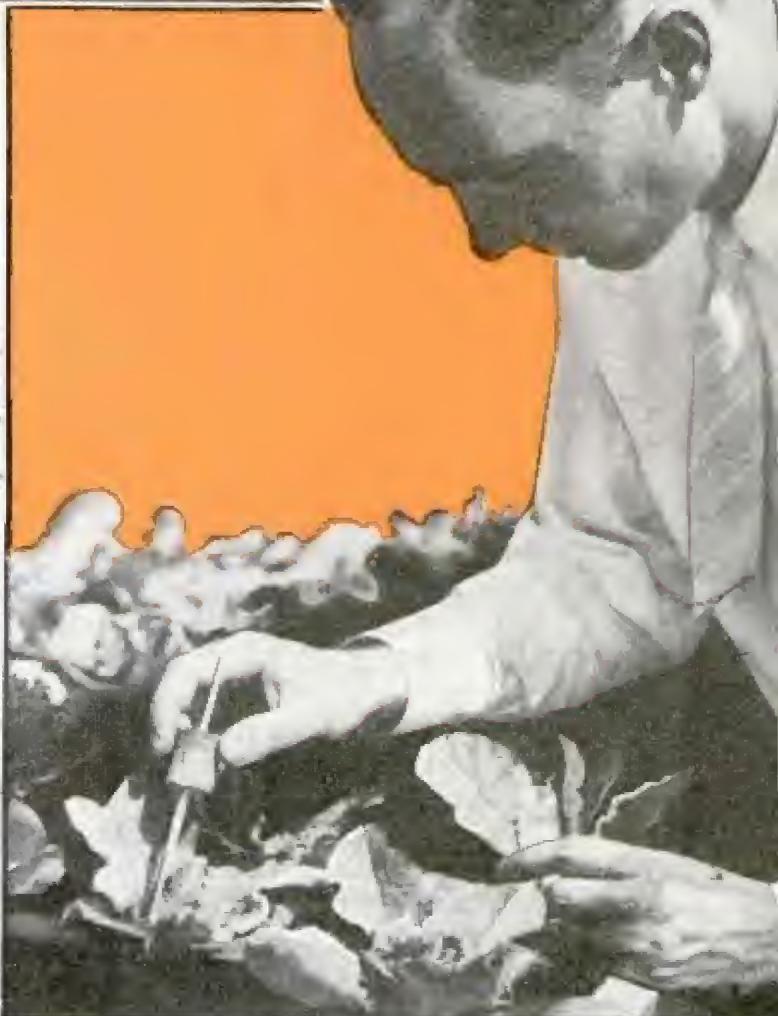
Already scientists have produced super-giant marigolds, zinnias, snapdragons, cosmos, petunias, calendulas, dahlias ten inches across on plants so tall you need a stepladder to pick them, and cuttings which speedily produce masses of roots. Most of this chemical plant growing is in the experimental stage but enough has come from the laboratories to assure us that the era of the chemical plant engineer is here.

with **CHEMICALS**



Of the chemicals used in redirecting plant life, most belong in a group known as synthetic plant-growth substances. They fool the plant into believing they are nature's own growth hormones—chemical substances produced in one part of the plant and transmitted to another where they tell that part how to grow and how fast to grow. Colchicine, an ancient drug long used medicinally, not only makes plants do strange things but alters the basic heritable characters of the plant so the changes become part of it and are passed on from generation to generation.

"It has been known for years that Mother Nature occasionally produces over-size plants differing fundamentally from their fellows," explains Gordon Morrison, geneticist for Ferry-Morse. "These are called mutations or mutants. Examine the tissue of these larger plants under the microscope and we see that the size of the cells is doubled. And what's equally important, each cell has a double dose of the heredi-



Top, year-old apple tree with desirable branch angles produced by hormone treatment. Circle, administering colchicine to dormant tobacco seeds. Bottom, treating growing point of hybrid tobacco plant with colchicine emulsion

Sept. 1937 - 901.



tary factors that determine the size of the plant, the color, size and fragrance of the blossoms, and other plant characteristics. These natural over-size plants yield over-size offsprings."

Nature is grudging in her production of such over-size offsprings; the odds against one are around a million-to-one. Furthermore, they are likely to occur where giant size is of no advantage, or in some out-of-the-way place where they never will be found. Plant scientists are constantly on the lookout for these breaks in the plan of nature, hence many of our fruits and flowers trace to an accidental over-size offspring which breeders located and made the foundation of a new strain. At the same time the search has been going on in the laboratory for a way of doing at will what nature does by whim.

There was great excitement in the plant-breeding world about four years ago when Dr. A. F. Blakeslee, plant scientist at the Carnegie Institution of Washington, reported that colchicine could be used to drug plants and alter the basic units of all plant life, the chromosomes, the microscopic bodies carrying the genes that transmit plant characters from one generation

18th and Hunting Park are phala

to the next. The colchicine is applied either to the seed, to the seedling, or to the growing plants in liquid or paste form.

Thanks to this strange drug, gardens this year are parading the first new flowers ever created by the use of a chemical. Burpee plant breeders created a giant marigold by giving a popular standard variety such a terrific internal colchicine "shock" it developed into a bigger plant. Using colchicine, Ferry-Morse has developed giant-flowered zinnias and cosmos as well as marigolds. The Bodger company also has put colchicine to work in developing new strains. Next year will see many new introductions of colchicine-developed flowers in seed catalogues.

When introducing the new giant marigold, David Burpee predicted: "I expect in the next few years to have some of the most amazing marigolds to show you that you could ever imagine." He will get these new marigolds by natural mating of the colchicine-produced variety with standard strains which could not be crossed because they did not have the same chromosome counts.



Top, spraying colchicine on growing plant tips where greatest growth activity occurs. Circle, putting chemical in bucket to be fed through garden hose. Bottom, plants are immersed in colchicine, then set out

X11 see no. 1937-682 K915
Austin.

Plant scientists at the U. S. Department of Agriculture point out that colchicine opens new fields of research in breeding cotton, cereals, tobacco, fruits and grasses by crossing varieties which hitherto could not be mated. In experiment stations throughout the country scientists are drug-
ging sugar beets, berries and fruits, seeking superior varieties. At the New York agricultural experiment station, Drs. Bernhard R. and Mabel Nebel are trying the power of colchicine to produce fruits that are bigger, more alluringly colored and juicier. They have used the drug to develop ten new snapdragons with blossoms of deeper color and plants of sturdier stems and to get a new spearmint with an aroma different from that of ordinary spearmint.

Colchicine is not for the average gardener to toy with. It is a deadly poison, and to use it successfully requires a thorough knowledge of the fundamentals of plant heredity. Neither is it a growth stimulator or a fertilizer.

Next let's turn to synthetic plant-growth substances. Less than ten years have passed since the first natural plant-growth hormones were extracted and reduced to crystalline form. That was the signal for chemists to start finding duplicates in the world of chemistry, substances which produce, under certain conditions, hormone-like reactions in plants. Included in the list are names like indole-butyric acid, indole-3-acetic acid, naphthalene acetic acid and a host of others. *Sept 22 1940*

One of the principal effects of some of the chemicals that masquerade as hormones is to make cuttings and plants root faster, which tends to speed up growth. These powerful root-forming chemicals commonly are diluted at the rate of one to 1,000 or sometimes as high as 100,000 parts of water or inert dust or paste carrier. Two California Institute of Technology scientists reported that a single ounce of one of the chemicals was capable of producing at least 10,000,000,000 new roots.

When it was found that synthetic hormones made plants and cuttings root with amazing speed, greenhouse and nursery people were quick to realize the value of this discovery. Now it is common practice for them to treat all cuttings before setting them out in the propagating beds.

At the U. S. Plant Introduction Gardens at Glenn Dale, Md., scientists with the Bu-

Super-Sensitive Lie Detector

Registers Any Emotion



She cannot tell a lie without showing it in lie detector through two electrodes fastened to palm

Relying on activity of the sweat glands induced by emotional reactions, instead of upon changes in the subject's blood pressure, breathing and temperature, a new lie detector called a psychometer is said to be more sensitive than former instruments. In making tests, two electrodes are strapped to the palm of the subject, and each time he attempts to tell an untruth a needle indicator swings far to the right. Emotions such as love, hate, sympathy and fear, sending electrical impulses through the nerve centers and activating the sweat glands, cause the needle to jump. *K908*

Putter with Paddle-Shaped Grip Improves Golfer's Game

Not satisfied with the grip of conventional putters, one professional golfer designed and patented a new-type handle which he attached to his regular club. The shaft and head of the club remain unchanged, but the old grip is replaced by a paddle-shaped block of wood having four flat sides. The inventor claims greater putting accuracy results from its use. *Acme*



(Continued to page 136A)

R825 Air-Raid Helmet Protects Head from Concussion



Trying protecting headgear on a yawning child.
Note head area that is guarded

After several years of investigation a specialist in nervous diseases has designed a helmet to protect the wearer's head from harmful effects resulting from concussion caused by bursting bombs or shells. The helmet is being produced in England. Frontal regions of the skull, the temples, ear openings and the base of the skull are guarded by the helmet, which is made of rubber containing millions of air cells.

R826 Pendulum Attached to Golf Club Helps Attain Smooth Swing

Practicing putting and short strokes with a pendulum attached to your golf club helps to develop a perfect swing, for the pendulum swings parallel to the club shaft as the stroke approaches perfection. This golf



684 1st and Madison
Des Moines, Iowa

swing "detector," just put on the market, fastens to the shaft by a clamp. With it you can practice golf strokes either outdoors, on a green or indoors on a rug.

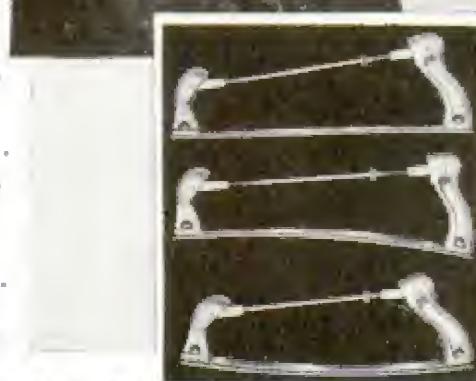
R859 Element Fitting All Oil Filters Has Metal Conversion Unit

Made to fit oil filters of all sizes, a filter element now available is made of cotton, and is of uniform density designed for long service. A metal conversion unit is supplied, to adapt the element to all makes and sizes of filters.



R774 Pistol-Grip Flexible File Holder Bends Blade to Suit Work

Both curved and flat surfaces may be filed with equal efficiency by fitting a flexible file blade into a new frame that holds the tool flat or bends it into various degrees of concave or convex shape. The holder, equipped with pistol grip, has an automatic stop to prevent bending files beyond their breaking point. The tool works with wood, steel, iron, hard rubber or marble.



Above, filing concave surface; below, tool adjusted (top to bottom) for flat, convex and concave surfaces

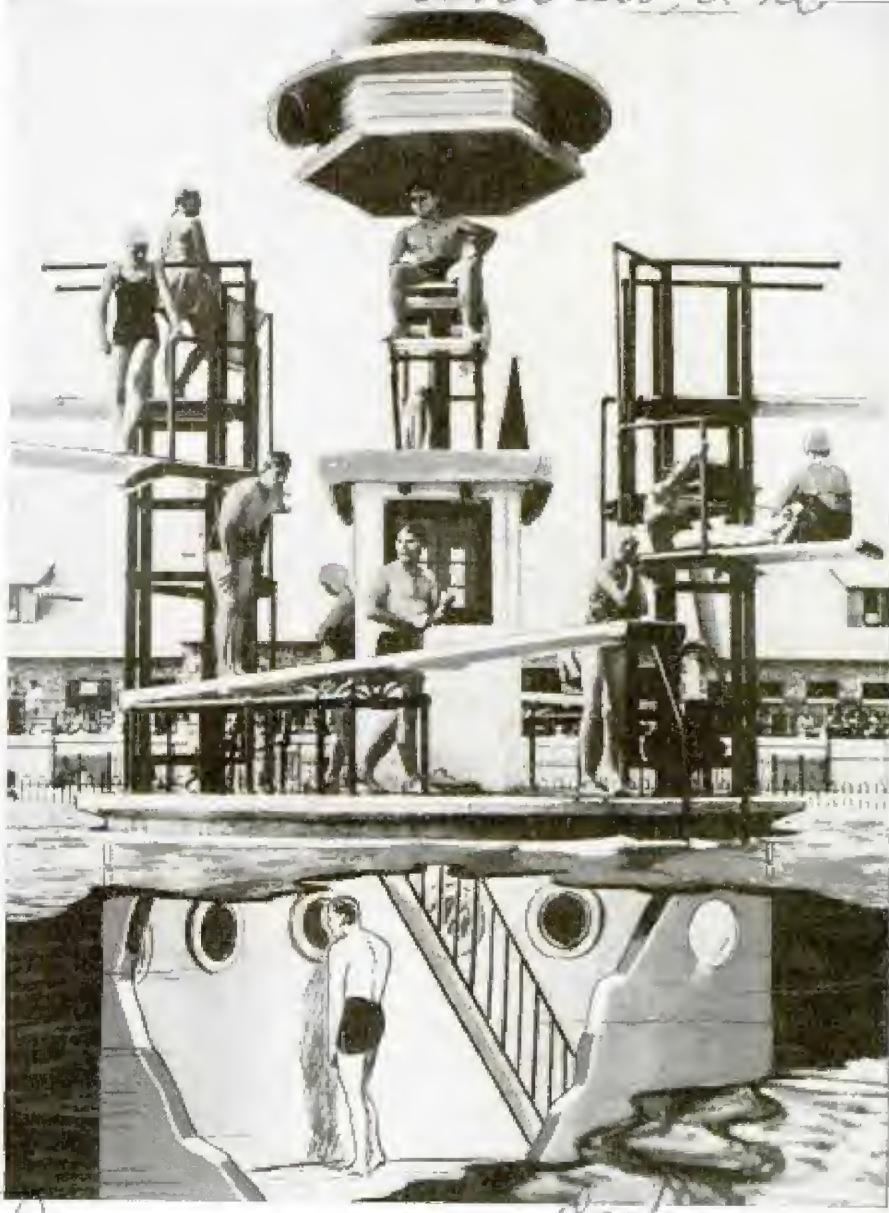
R 794.

Rosewell Park.

Underwater Portholes Guard Swimming Pool

Lifeguards at a new circular bathing pool in Illinois have an underwater lookout room fitted with portholes through which they can watch swimmers beneath the surface. The room is built below a diving tower located in the middle of the tank where the water is deepest. Other guards stand watch at the top of the island.

Diving tower, right, with lookout room below where lifeguards may keep watch of swimmers beneath the surface; below, photograph of swimmer as seen through one of the portholes



R 850

dn.

Four-Foot Electric Cabinet Ages Hams in Seven Weeks



Fifteen hams at one time can be cured in this electric cabinet, which can be plugged in wherever there is a 110-volt outlet

It used to take from one to three years to give hams that "country-cured" flavor. Now the aging is accomplished in seven weeks in an electric cabinet, the modern successor to the traditional smokehouse. The cabinet measures twenty-four by thirty by forty-eight inches, and can be used wherever there is a 110-120-volt outlet. It is insulated, and inside is a 200-watt bulb and a thermostat which keeps the temperature at 110 degrees. One test of the cabinet showed a shrinkage of only nine and one-half per cent, while smokehouse shrinkage sometimes reaches twenty per cent.

Developed by Tennessee Valley Authority, Knoxville

K68 b. 1945
John A. Moore, 11 1/4 Walnut,
Blasenreuth



FUN with



As indoor amusement, balancing a paper cone is safe for both the household and yourself. It looks difficult, but its air resistance compensates for its lightness. Cone is made from two pages of newspaper fastened with two pins. First try balancing it on your finger, as at right, keeping eyes on top of cone. On the chin (circle) you learn all over again because you view it differently. Then (above) pull out your necktie for a support; this one is easy



Steady hands are needed to balance the cone on a slack string. After deciding how much slack you want in the string, two knots are tied, marking the distance. Now lay string loosely over palm of right hand, placing cone on the string and balancing it in that position (left). Quickly catch the hanging string between thumb and palm of left hand, turn both hands with palms vertical (above), and the trick is begun. Getting this started is the hardest part, but you must remember to watch top of cone as string is slackened

BALANCING TRICKS

K688



Having mastered the paper cone, let's step out in the back yard with the kitchen broom, where there is no bric-a-brac to damage. Right, it is easy to juggle the broom on one hand after practice with the paper cone. Below, if broom slips from your chin it is easy to dodge, but try to make it fall away from you. Don't let your neck muscles do all the balancing; if you use the muscles of the lower back, the exercise will be a pleasant surprise



Above, the elbow balance is more difficult as all control comes from the trunk muscles; after you have tried this, place the broom on your shoulder and balance. Circle, toe balance requires a supple left ankle, since the body must be supported and balanced by the left foot and leg while the right leg balances the broom, and you look it all over from above. If you have a tendency to wander in performing these stunts, you can discipline yourself by keeping the left foot in place all the time, even at the expense of losing balance. If one broom becomes too simple, try two at a time

R884 Radio Dry Cells Recharged by House Current

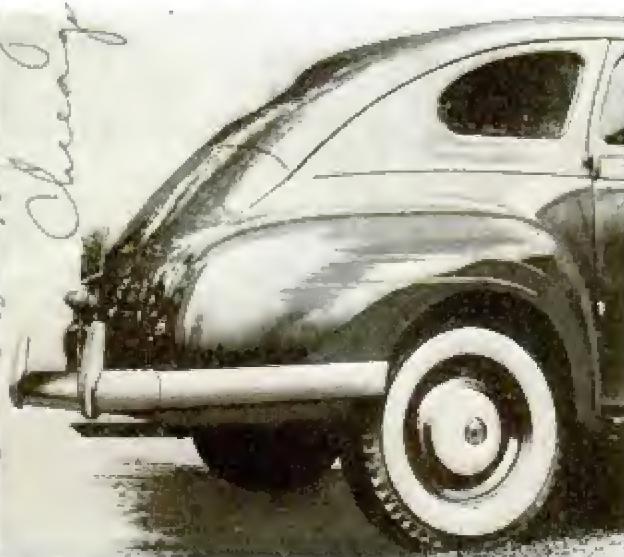


R842 R. Wilkes, June, 1942
Rectifying unit, using house current, here seen plugged into portable radio to charge dry batteries

Dry cells of portable radio sets, hearing-aid devices and similar appliances can be recharged overnight with house current by means of a small rectifier unit with a new type of vacuum tube. Both "A" and "B" batteries are charged at the same time.

R873 Guard Protects Auto Fenders from Curb or Side Swiping

Ready for attachment to all popular makes of cars, a metal guard protects the rear fenders from side swiping and from



Linton, 1942, November 20
Steel bar attached to bumper and chassis guards rear fender from side swiping and scraping against curbs

scraping on curbs. Made of spring steel and chromium plated, the protective bar attaches to the bumper with strong bolts, requiring no boring of holes. It does not touch the fender, but curves around the fender section nearest the rear wheel and is secured with a clamp to the chassis.

R841 Robot Reports State of Weather by Automatic Radio

Self-reporting weather instruments are making it possible to collect data from points far removed from any human habitation. The latest of these is a radio robot



Remote weather station gathers information and automatically transmits radio reports at fixed periods

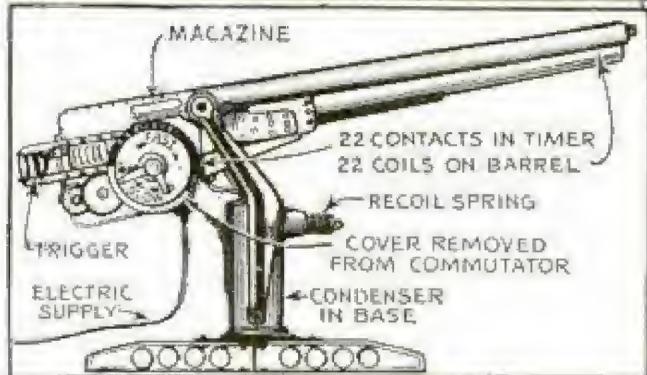
developed by experts of the National Bureau of Standards. It will report automatically by radio at fixed intervals the barometric pressure, temperature, humidity, wind direction and velocity, and rainfall.

Washington, D.C.
Grand Coulee dam contains sufficient concrete to provide a souvenir weighing thirty-six and one-half pounds for every person in the United States.

K822 / Angel Nagyby, Hotel Texas Flashless Electric Machine Gun Fires Silently

Magnetic coils jerk bullets through the barrel of an electric machine gun that fires silently, without a flash. Still in the experimental stage, the working model built by a Texas inventor fires its bullets with a muzzle velocity of 400 feet per second; to be effective in warfare, a velocity of 3,000 feet per second would be essential. Steps are being taken to produce a higher-powered gun. Since there is neither flash nor smoke, the gun could spray bullets at an enemy without being detected, and it can fire continuously without heating. Batteries or power line furnish the propellant, and in actual maneuvers electricity could be supplied by a generator on the truck carrying the gun. The model fires only seventy .44-caliber shots a minute, but the full-scale gun would be built to fire 600 a minute.

K820
Top, working model of powderless machine gun using magnetic coils to fire bullets without flash, noise or smoke. Bottom, sketch shows proposed details of full-size electric gun calculated to fire 600 shots a minute with muzzle velocities near 3,000 feet a second



K820 Paint Color Mixer for Store Saves Carrying Large Stock

Present methods of merchandising paint in stores may undergo a change if a re-

Paint Color Mixer



K820
With this mixer storekeeper can blend any desired color in can of base paint while customer looks on

cently patented paint color mixer is adopted for general use. Enabling the store-keeper to carry an unlimited variety of colors with only a small number of cans of base paint, the machine ejects the selected color from a cartridge-like tube into any size can, then mixes it thoroughly by a rotary motion while you wait. The operation requires no more than two minutes.

K821 Fist Billy Loaded with Lead Shot Adjusts to Fit the Hand

K821
Police and other law officers are fortifying their hands with a "fist billy," a heavy leather fist cover that is loaded with fine shot. It is held on by straps, adjustable to fit the officer's hand.



Reel Holding Electric Wire Feeds Flat Extension Tape

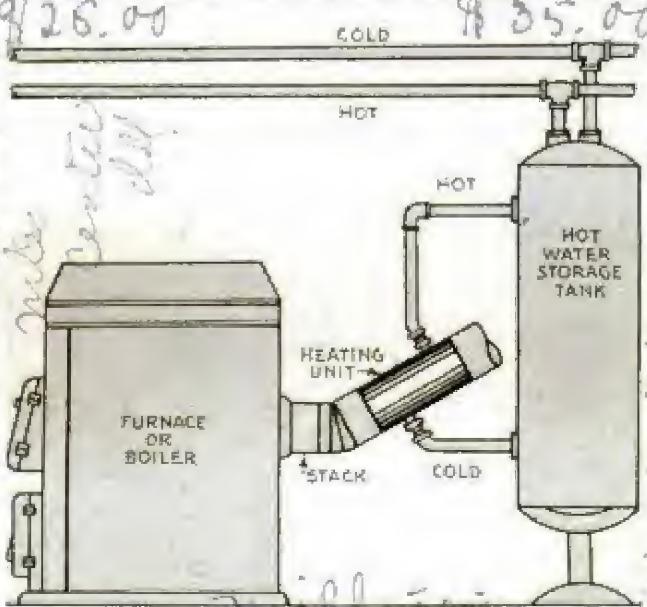


Flat electric cord on reel extends up to fifteen feet from wall plug to reach electric appliance

Fifteen feet of flat electric extension cord are housed in a metal-cased reel that feeds out the exact amount needed to reach the appliance. There is a rewind lever in the recessed bottom of the container. The end of the cord plugs into the floor or wall socket, the appliance plug connects with the socket in the side of the reel case.

Hot-Water Unit in Furnace Flue Captures Waste Heat

Heat that escapes into the flue is made to heat water circulating through a unit.



Water-heating unit installed between plant and chimney uses escaping heat to keep water hot in tank

installed in the flue pipe between the furnace or boiler and the damper. It will heat water directly for household use or deliver pre-heated water to hot-water heaters, and the units are adapted for installation on hot-water, steam, vapor or warm-air heating plants whether they are fired by coal, oil or gas.

Deer Traps Baited with Apples Used in Restocking Forests

Two-compartment traps are used in the Ozark National Forest of Arkansas for capturing deer to be used in restocking other areas. The front compartment is five by five by six feet, made of strong, fine-mesh wire; the rear compartment of rough lumber is three by three by nine. The traps are used chiefly in winter, and are baited with apples. A deer smells the apple and



Setting trap baited with apples to catch deer in one forest for removal to another that needs restocking

steps into the front compartment. As it reaches for the apple it touches a wire, tripping a figure-four trigger and dropping the front door behind it. The way is clear to the rear and the deer leaps forward, only to trip another wire which closes the middle door as a rope releases the rear door. The deer is caught in the rear compartment, ready for removal by rangers to an area where deer are scarce.

Stamped, self-addressed envelope, sent to our Bureau of Information, will bring you the name and address of the maker of any article described in Popular Mechanics.

R254. 813 Santa Barbara St.
Pasadena, Calif.

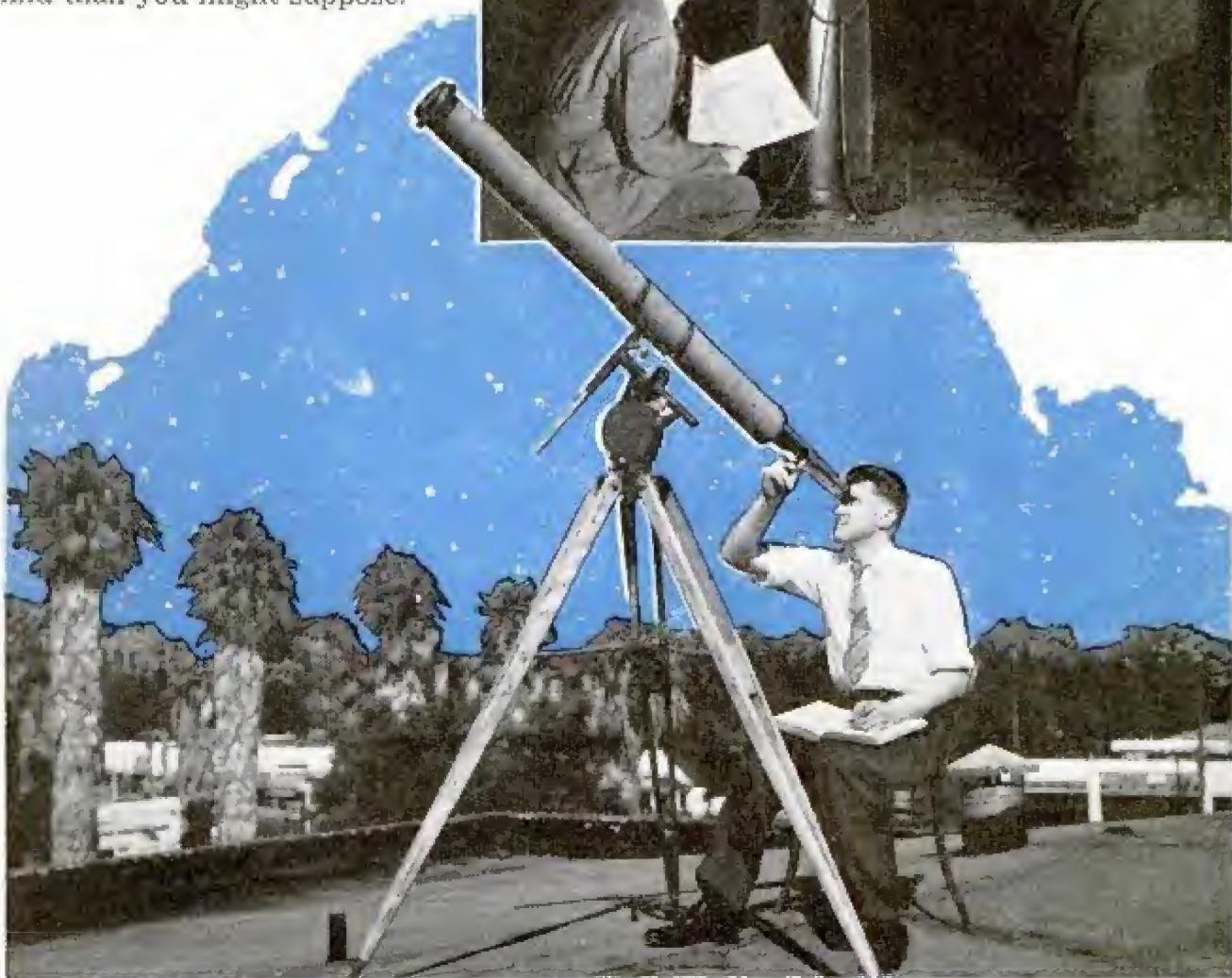
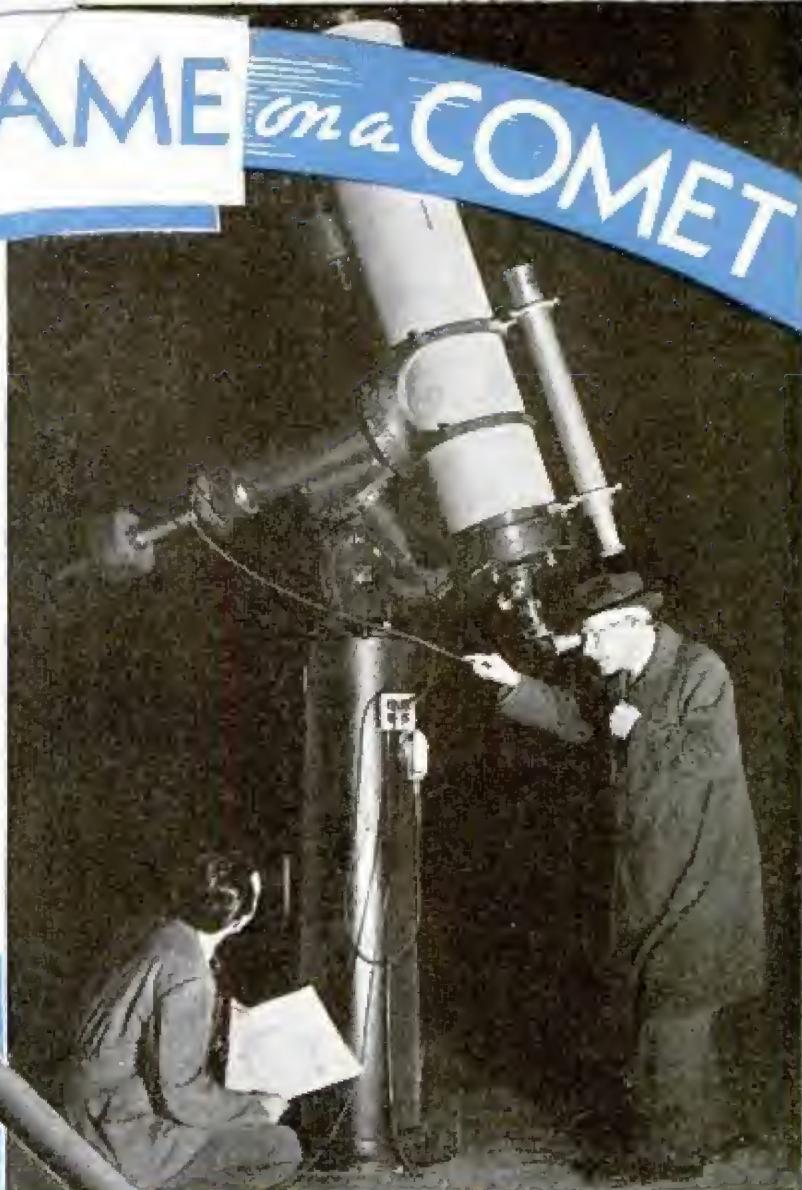
PIN Your NAME on a COMET

By R. S. Richardson
and Glenn C. Moore

of Mount Wilson Observatory

WOULD you get a thrill out of glancing upward some night and casually remarking to your friends, "Well, I see my comet is much brighter than it was last week?"

Would you like to feel you have a place among the stars, no matter how small? Then why not hunt comets as a hobby? They are much easier to find than you might suppose.



Top, two astronomers on a comet hunt. Comets have been discovered with telescopes much smaller than instrument at bottom; Messier, French 18th century astronomer, found thirteen with a two-foot telescope



Left, finding comet's position by measuring distance from star trails on photographic plate. Right, a good comet seeker is made for a few dollars. Below, adjusting position of ten-inch photographic telescope

But, you object, you have only a little homemade reflector, or perhaps a spyglass with a two-inch lens. You couldn't compete against professional stargazers with their powerful instruments.

The answer is that you don't need a big telescope. In fact, a big telescope is actually a handicap in this work. Most comets are picked up by amateurs exploring the sky simply for fun. The discovery of Nagata's comet is an example.

Masaji Nagata was a Japanese farmer in the Imperial Valley of California. At night he loved to lay aside his tools and study the heavens with his three-inch telescope. On the evening of July 15, 1931, examining the planet Neptune, he noticed a hazy star near by, so near the horizon he was unable to watch it for more than a few minutes. The following night he searched earlier and found it had moved a considerable distance from its position the night before.

Now the stars stay fixed in the sky with respect to each other, but planets and comets keep moving about. Nagata knew it was not a planet because of its hazy appearance. He suspected at once, therefore, that he had come across a comet. He communicated his observations to the Mount Wilson Observatory which soon confirmed his discovery. Nagata was presented with a medal by the Astronomical Society of the Pacific, in addition to having the comet named after him. Today Nagata is dead, but his comet still pursues its path across the sky.

A big telescope is a handicap because it magnifies too much. It is like searching for a collar button with a high-power microscope. A big telescope magnifies so much that it can only see an area in the sky equal to about ten per cent of that covered by the full moon. A small telescope takes in an area hundreds of times greater. The chief requirement in success-





Above, Halley's Comet in 1910. Right, light from stars reflects from mirror at bottom of tube to eyepiece at top. Center, photo shows comet clearly as telescope follows it, stars appear as streaks. Bottom, two back-yard comet chasers

ful comet hunting is persistence. Charles Messier, French astronomer of the eighteenth century, discovered thirteen comets with a telescope two feet long!

The comet hunter stalks his prey in a systematic manner. He carefully scans a narrow strip of the sky, pausing occasionally to study some suspicious object. Then he shifts his telescope slightly, and repeats the process. He may continue in this way for months and even years without seeing anything more exciting than a shooting star. But he does not become discouraged because he knows that by keeping at it he is practically certain to find a comet in the end.

People generally picture a comet as a bright star with a long tail streaming behind. Instead most of them appear in the telescope as a faint blur, often without a following train of light. Sooner or later the amateur will see such a faint blur. Immediately his spirits soar. A comet at last!

But wait a minute. Before announcing your discovery to the world, make sure you have not found a star cluster or a nebula.

(Continued to page 134A)



Halley's Comet
Photo by W. H. Smith
Printed on back of card, Nov. 2, 1937

Car Rocker Finds Squeaks and Spreads Lubricants



Automobile service man rocks car with foot-powered jack to find squeaks and work grease into all parts

Hidden squeaks in automobiles may be detected by a new jack that rocks the car and helps in spreading grease to parts ordinarily hard to lubricate. Operated by a foot pedal, a fifty-pound pressure exerts more than 400 pounds pressure on the load. The pedal folds and the jack may be moved to another job by rolling it on its base.

Propeller Drives Model Racer Forty-Five Miles an Hour

Its frame made from an old apple box and its body of balsa wood, a model racing car driven by a pusher air propeller trav-

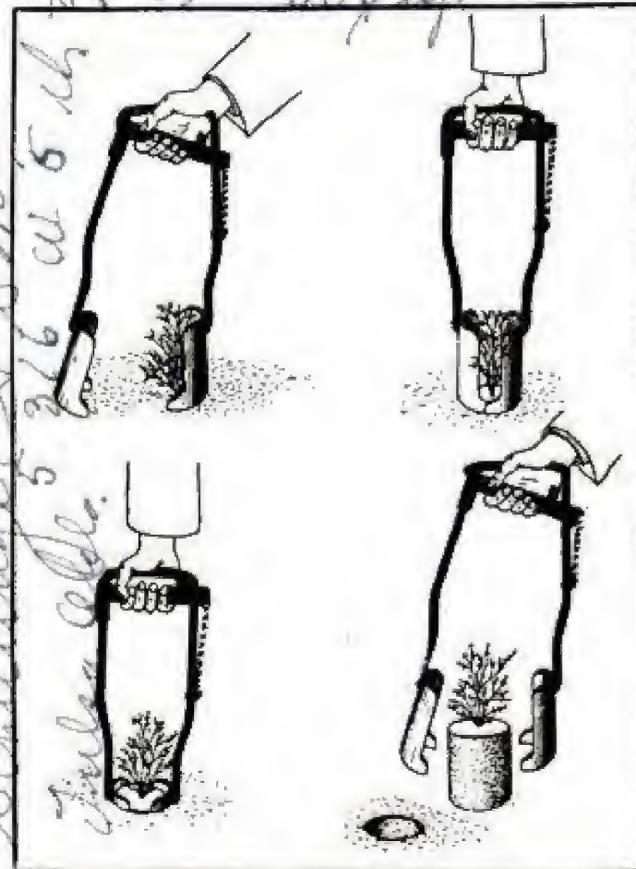


One-fifth horsepower motor drives the pusher propeller of this four-pound miniature racer

els forty-five miles an hour. A bridle attached on the left side keeps the car going in a circle around the operator, who can stop it by tapping a vertical rod which cuts a switch at the edge of the hood. The one-fifth horsepower motor is in the rear, while the coil, batteries and ignition switch are under the hood. The racer weighs only four pounds.

Transplanting Tool Digs Up Plant with Earth-Packed Roots

Plants and bulbs are easily set in the soil or transplanted with a simple garden tool that removes plants intact from the ground with enough earth around the roots to give them a good start. The tool, operating like a posthole digger, is placed around the



To dig up plant, place tool over it, squeeze tool closed, force into ground, pull up and release grip

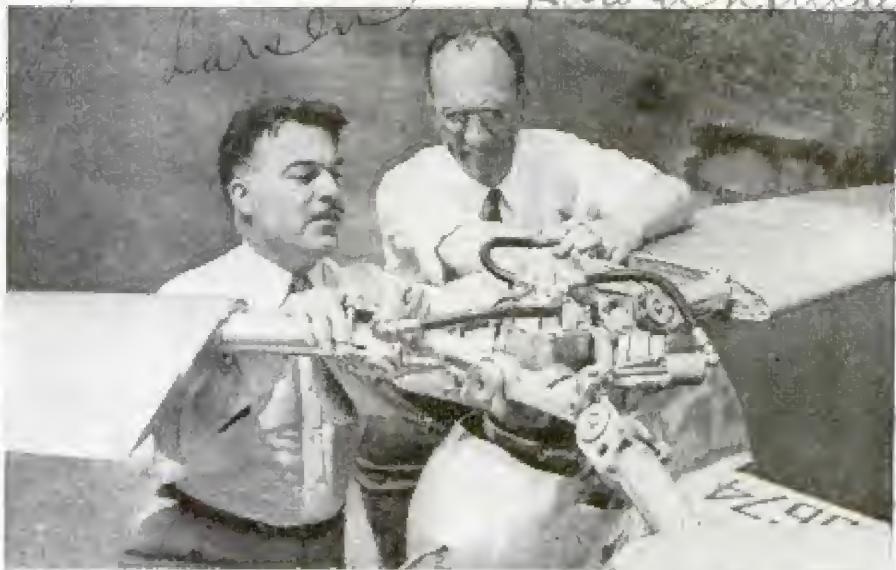
plant or shrub and with a downward push it is forced to the desired depth. To break the earth core the tool is rotated and the plant is ready to be pulled from the ground. Several sizes are available, the smaller ones being operated entirely by hand, and the larger tools by foot.

Send stamped, addressed envelope to our Bureau of Information for name of maker of any device described in this magazine.

8883 Hatboro, Pa. Metal Autogiro Rises Vertically from Ground

Your back yard is an ample landing field for the newest autogiro, despite the garden fence, the telephone lines and the neighboring chimneys. A rotor mechanism invented by Agnew Larsen, engineer and general manager of the Pitcairn Autogiro Corporation, makes the all-metal craft capable of vertical flight. In its first public demonstration recently the PA-36 autogiro climbed straight up to clear an artificial hazard and then was driven forward by the single propeller in its nose. The three big rotor blades provide lifting power and allow a takeoff or landing in a tiny area. The new autogiro is an enclosed type.

Top, rotor hub of autogiro, heart of the rotor blade mechanism, undergoes inspection by Agnew Larsen, its inventor, at left, and Harold F. Pitcairn, president of the autogiro company. Bottom, the new PA-36 autogiro, in first public demonstration, rose vertically from ground and then was flown horizontally over artificial obstacle, to show the craft's independence of ground hazards



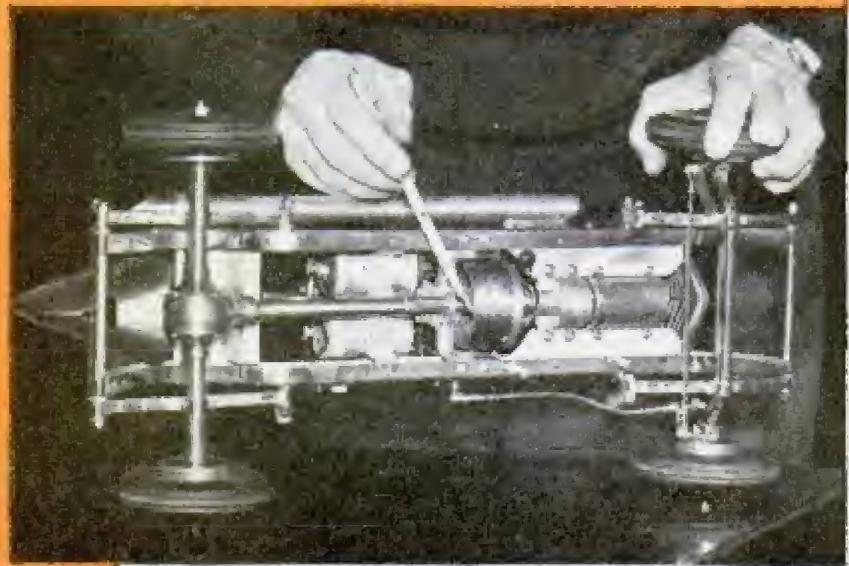
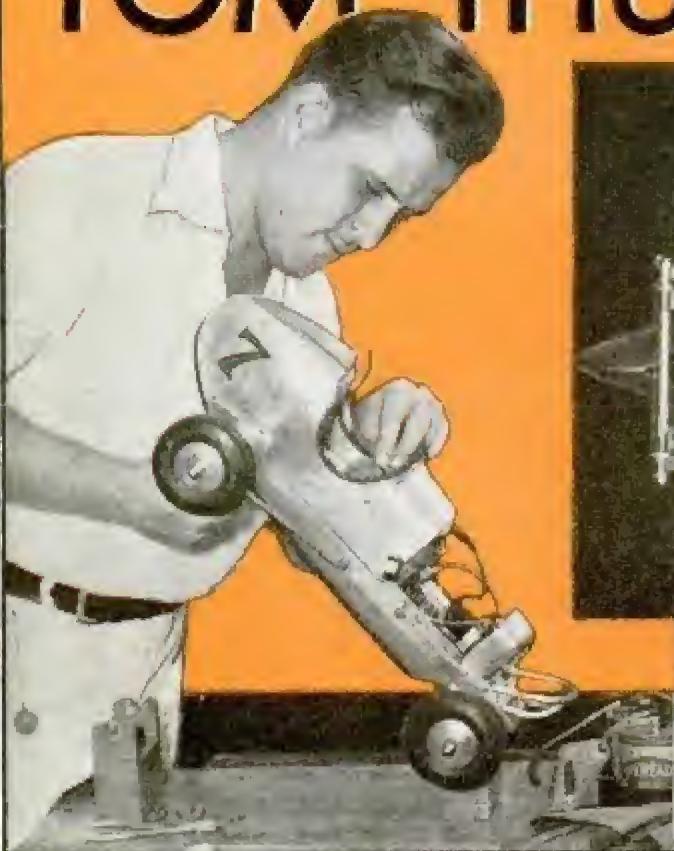
Baby Keyboard Added to Piano Plays Orchestral Tones



Electric keyboard is attached at right side of piano

Tones of the flute, strings, reeds and a variety of other orchestral sounds can be produced by a small electric keyboard which is attached to the right side of the piano. This new instrument is the Solovox, invented by Laurens Hammond and based upon the same principle as his Novachord, which derives its tones from controlled oscillations of many radio tubes. The Solovox has fourteen tubes, with a range of six octaves and tablets to control the various voices. It can be played by any amateur musician. A cable leads from the keyboard to the tone cabinet under the piano.

TOM THUMB CARS



Left, owner working on his midget racing car. Above, combination clutch and universal joint that operates by centrifugal force. Below, crowd watching miniature racing-car events at New York world's fair. Note tiny speedster hurtling along at left. It is held on its course by a cable, invisible in photo, attached to swivel at center of course



"CAR 9 on the track—No. 15 on deck—"

The announcer's voice is lost in the noise from the starting table adjoining the track. A miniature racing car is being tuned up for a run. With the deftness of a watch repairer, the car owner manipulates the needle valve of the carburetor until the scream of the motor satisfies him, then moves his car to the starting line and tethers it to an airplane cable running to a swivel in the center of the circular course.

The starter nods and with a quick push he sends the car roaring on its way. Around

the circular track it streaks, gathering speed. Three test laps completed, two of the track officials press on their stop watches and the race against time begins.

Spectators move to the edge of their seats. First-timers rub their eyes in amazement—the speed of the car is as incredible as the noise of its exhaust. When the car has negotiated eight laps, it is brought to a halt by the owner tripping its ignition switch with a handkerchief. He unbridles his car to make way for the next and awaits the announcement of his car's time.

BURN UP the TRACK



Time clocks are checked against each other and with the aid of a slide rule, the clerk calculates Car No. 9's average speed. Others take their turn and when all times are posted, the champion is named, and, if it happens to be an intercity or a sectional meet, team standings are tabulated on a point system. If the company's fast, the top car may be close to the present record of 62.23 miles per hour.

Although the beginnings of vest-pocket racing are clouded in obscurity, California hobbyists went off the deep end for it last year and soon their enthusiasm fanned out over the country, climaxing in races at the New York and San Francisco expositions. Since then it has proved a magnet for crowds and in a few localities is outdrawing the regular midget race tracks. Miniature racing has, from the outset, been adult in appeal. In virtually every racing association garage mechanics, butchers, hotel clerks, salesmen, office workers, and professional men will outnumber high-school youths five to one.

Ready-built cars cost twenty-five dollars and up—and up, if your tastes run to high-precision, custom-made jobs. On an average track, a driver spends about forty dollars for his first racing equip-



Top, left, driver stopping car by tripping ignition switch. Right, tuning up car on electrically driven starting table. Bottom, driver attaching car's "bridle" to cable leading to pivot pole

R 52
ally will go over 100 miles an hour!

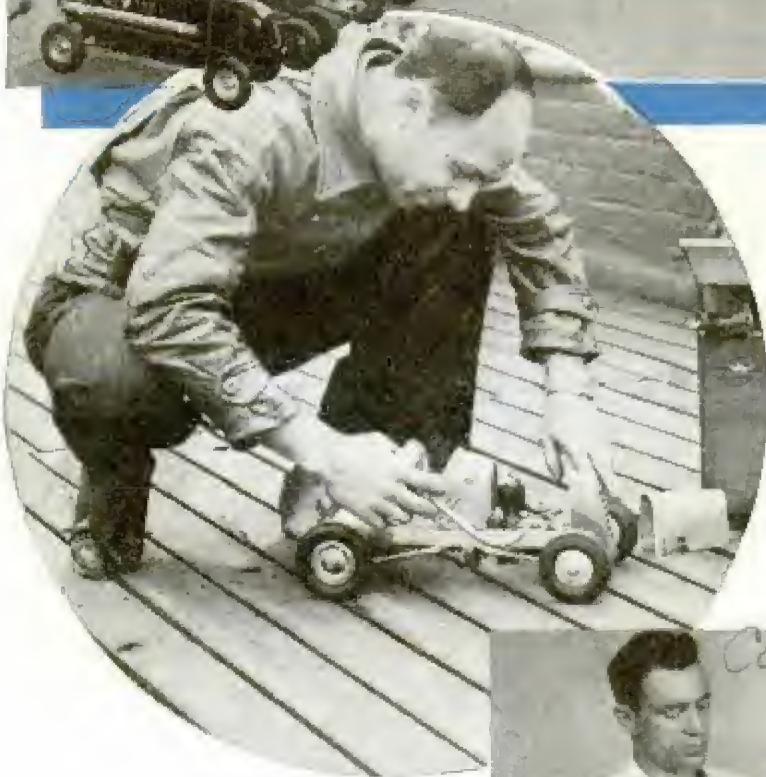
Knockdown kits of complete cars that a hobbyist can assemble are highly popular and, of course, a lot easier on the pocketbook. A home-workshop owner with the necessary tools and patience can build his own racer, with the exception of the motor and tires.

Experimenting is a part of the fun. Different body styles will challenge the driver's interest and his quest for an ideal fuel for his motor is apt to be unending. The owner of a front-drive racer will set about to probe the advantages of the back drive and vice versa. The same

is likely to be true in testing the relative merits of friction and gear drives, and after a time, will come the urge to "hop up" a motor or work out a supercharger.

The regulation track is one-sixteenth of a mile and in its center is a swivel or pivot made out of a ball-bearing roller skate fastened to a securely moored pipe, eighteen inches to three and a half feet high. Fine steel airplane cable

(Continued to page 124A)



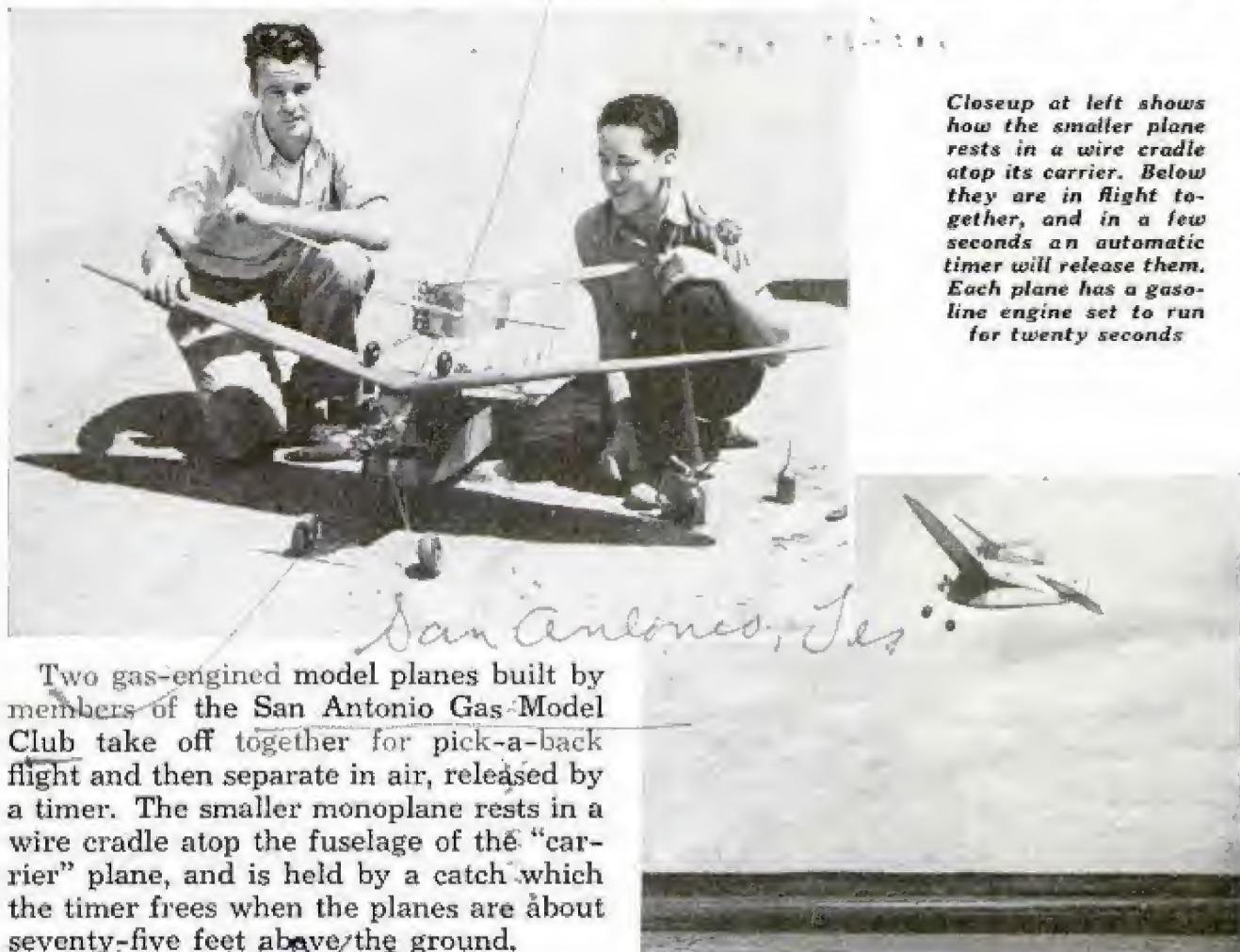
ment. He may feel the urge for a new car that will give him greater speed and if he's ready to plunk down \$175 he can have one built to his own specifications. Its parts will be dynamically balanced and weighed to the hundredths of an ounce and the precision grinding of important parts will be accurate down to 1/10,000 of an inch. Engineers making these hand-built jobs feel that their speed eventu-



Top, several miniature cars participating in events at world's fair. Circle, fueling tiny car. Bottom, former racing-car designer, who has become top-flight builder in miniature field, at work on the small speedsters

R. 887 Fred Tropper and Lee Sherman

Timer Releases Pick-a-Back Models in Flight



Two gas-engined model planes built by members of the San Antonio Gas Model Club take off together for pick-a-back flight and then separate in air, released by a timer. The smaller monoplane rests in a wire cradle atop the fuselage of the "carrier" plane, and is held by a catch which the timer frees when the planes are about seventy-five feet above the ground.

Closeup at left shows how the smaller plane rests in a wire cradle atop its carrier. Below they are in flight together, and in a few seconds an automatic timer will release them. Each plane has a gasoline engine set to run for twenty seconds

Armored Jacket Stops Bullets from High-Powered Rifle

— R 862 —
Weighing only fifteen pounds, a laminated steel jacket designed as the suit of armor for modern soldiers has stopped bullets from a submachine gun and from

a German Mauser pistol fired at a twenty-five-yard range. With a solid sheet of heavy steel instead of the laminated steel and rubber, the jacket would weigh twenty-one pounds and would withstand high-power rifle fire, the inventor says. Three layers of steel $25/1,000$ of an inch thick are used in front, two layers in back, separated by narrow strips of rubber.



Soldier wearing bullet-resistant jacket of laminated rubber and steel is protected on all sides

R 897

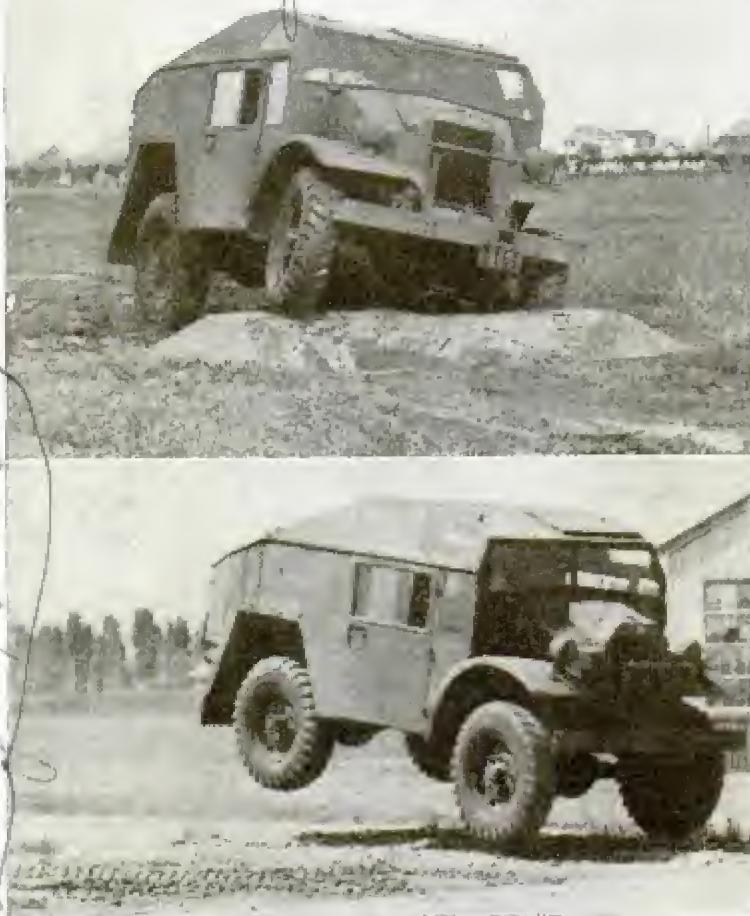
Decorative Plaque for Wall Covers Electric Switch

Electric switches on the home walls can be covered with an ornamental plaque which fits snugly against the wall. As the plaque is moved up or down it turns the hidden toggle switch on and off.



Rough Riding Gun Tractor Goes through Severe Tests

no further data



Gun tractor built for rough going, top, climbs slippery obstruction; bottom, kicks up rear wheels bouncing from pit

Windsor, Ont. *Code #402*
Designed to negotiate almost impossible terrain, a new type of British gun tractor has completed severe tests at the Ford Canadian plant. Among other requirements, the tractor must crawl over obstructions greasy with mud and it must travel over a deep ditch, a test that causes it to bounce like a bucking bronco.

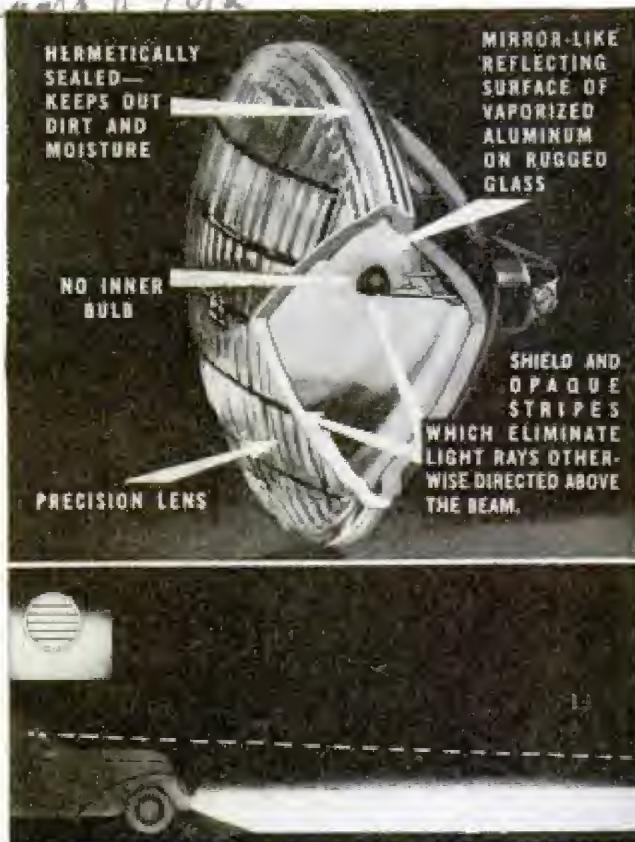
Sunburn Prevented by Windows in Stratosphere Planes

Although stratosphere flying is not as yet commercially practical, the optical industry already is prepared to equip airplane windows with glass that will absorb invisible ultraviolet rays which can destroy the human skin in two or three minutes, and even destroy life, at altitudes of fifteen miles or more. On earth we are protected from the severity of these rays, which cause sunburn, because the very short wave lengths they contain are filtered out by ozone in the atmosphere. One kind of glass will not pass ultraviolet but admits

heat in the form of infrared, yet it will keep the heat from escaping once it is inside. Another kind of glass absorbs both the ultraviolet and infrared, thus also excluding the heat rays. On a stratosphere ship equipped with sliding windows having these two types of glass, the pilot would manipulate them to protect against the invisible rays and also control the interior temperature.

Fog Lamp Slants Its Rays to Avoid Bright Curtain

Caprice *100* *Brake* *26* *2876*
Better visibility in fog is the purpose of an all-glass automobile lamp closely resembling the "sealed-beam" headlamps recently introduced. The new fog lamp has a small black hood in front of its filament and five opaque stripes horizontally across the inner surface of the lens. The hood and stripes intercept "wild" rays which, unless controlled, shine ahead and create a bright fog curtain that hampers the driver's view in "soupy" weather. The lamp throws practically no light above the horizontal plane.



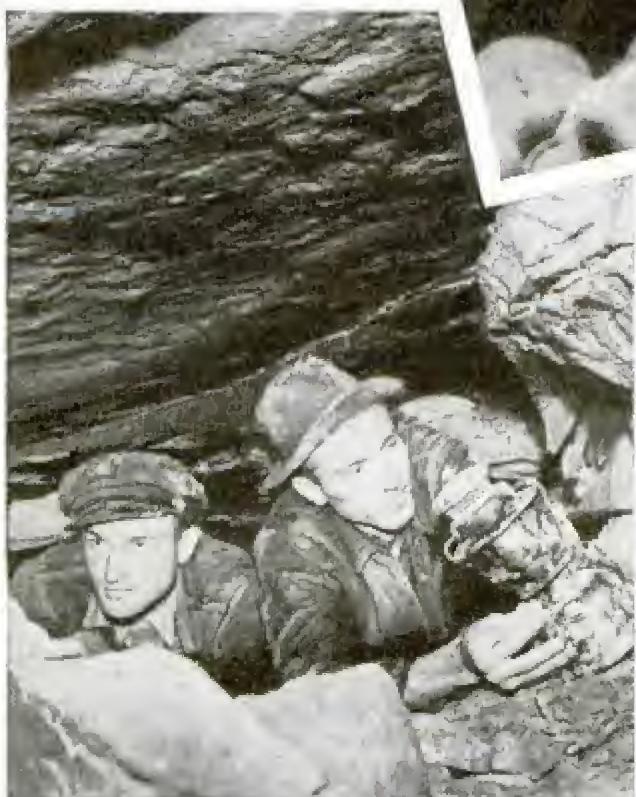
Drawing at bottom shows how the hooded fog lamp throws its beam low and avoids lighting up the mist

808

Quest for Blind Fish Discloses Hidden Caves



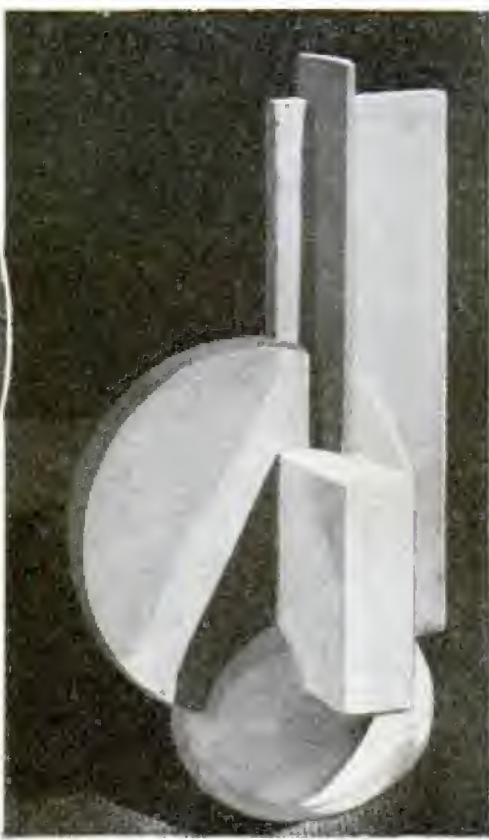
Back in 1938 two guides were sent into recesses of Mammoth Cave, Kentucky, to obtain specimens of blind fish for exhibition. They traveled subterranean rivers and tortuous crawlways, discovering magnificent caverns still unopened to the public. Scientists describe them as more beautiful and geologically valuable than the familiar caves. Above, guides exploring with rope



Upper right, Carl Hanson and Lee Hunt catching blind fish (center picture) in Roaring river. Lower left, guides emerge from 800-foot crawlway into new-found labyrinths. In that distance they could seldom rise to hands and knees. Below, a deposit of cave pearls. Explorers are making extensive studies before admitting public to new sections



ART



K672.

Art students, expecting to be taught at the traditional desk with pencil and paper, are surprised to find themselves seated at a workbench upon entering classes at some modern art schools where the pupils work with wire, solder, sheet metal, plastic wood, plaster and lead, using metal shears, pliers, hammers and other tools, to learn how things really are formed, instead of how they look to the eye. Students thus learn to handle the same material and tools which they are likely to use in earning their living in the mechanical trades. In one of the first lessons, students put together nature's favorite forms, the sphere, dish, cylinder and cone, and man's invented form, the rectangle, like plastic wood group above, in pleasing, though unfamiliar, combinations. Circle, fashioning cowboy and lariat with pliers. Left, artistic example of pomp and strut modeled in sheet-metal lady. Straining cowboy and balking horse, below, indicate how lights on metal emphasize life and action



from the WORKBENCH



In final "bench" lessons, the student is given an opportunity to create a familiar figure from life in three dimensions, sculpturing his model in plastic wood or plaster. Above, symbolic figure suggesting a husky scrub woman bearing down with soap, water and scrub brush. Right, student modeling group showing mother washing child



At left, student working with thin sheet metal learns how to enclose bulk by plane surfaces and to give emphasis to form by employing light reflections; metal shears are the tools used. Below, wire race horse and jockey created by student depicts both volume and action in simple lines better than could be done with pencil lines on paper. The purpose of this new kind of training, as employed at the Pratt Institute in Brooklyn, is to teach the fundamentals of art by experience in creating actual objects, giving the student a clearer conception of form and outline than is possible with theoretical forms produced by pencil, which the student must forget until he has finished the preliminary course

215 Avenue



Speed-Light Warns Driver When Limit Is Reached



Top, turning control knob to set auto speed-light; sketch below shows installation of light and switch

Lighting automatically as soon as the car exceeds the speed at which it is set, an indicator helps the driver stay within the desired limit. The lamp is a small plastic head with a suction cup that may be stuck any place on the windshield. A control knob mounted either beneath or through the instrument panel enables the driver to set the maximum speed at which he wishes the device to function, depending on the speed laws of his locality. Wind coming from the fan operates the switch, which is attached at the front end of the motor.

Invisible Film to Mend Drawings Is Applied with Heat

Kel 9308 Patch
Torn blueprints and drawings can be mended with a "vanishing" film which is applied with a thermostatically controlled welding iron. This transparent film has no oozy adhesive which will seep out and become sticky in the blueprint machine or when the drawings are filed away. When

1535 N. Euclid Ave
a blueprint is made from a tracing previously mended with the thermoplastic patch, the mend cannot be seen on the blueprint.

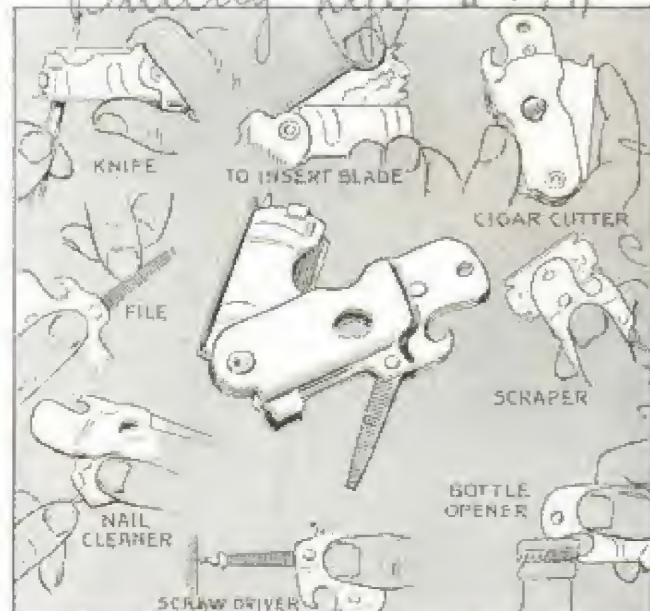
K 590 *Chicago* Fluorescent Lights for Ceiling

Suspension fixtures for installation of fluorescent lights at the ceiling are now available, offering bright light at low wattage without the heat of the incandescent lamp. There are two, three and four-tube units, the tubes snapping into Bakelite sockets, while the starter switch and reactor are built into the fixture. The fluorescent tubes are available in "sunlight," warm white, green, blue, red, pink and gold.



K 733 *Buddy life* Razor Blade Knife and Scraper Has Many Handy Uses

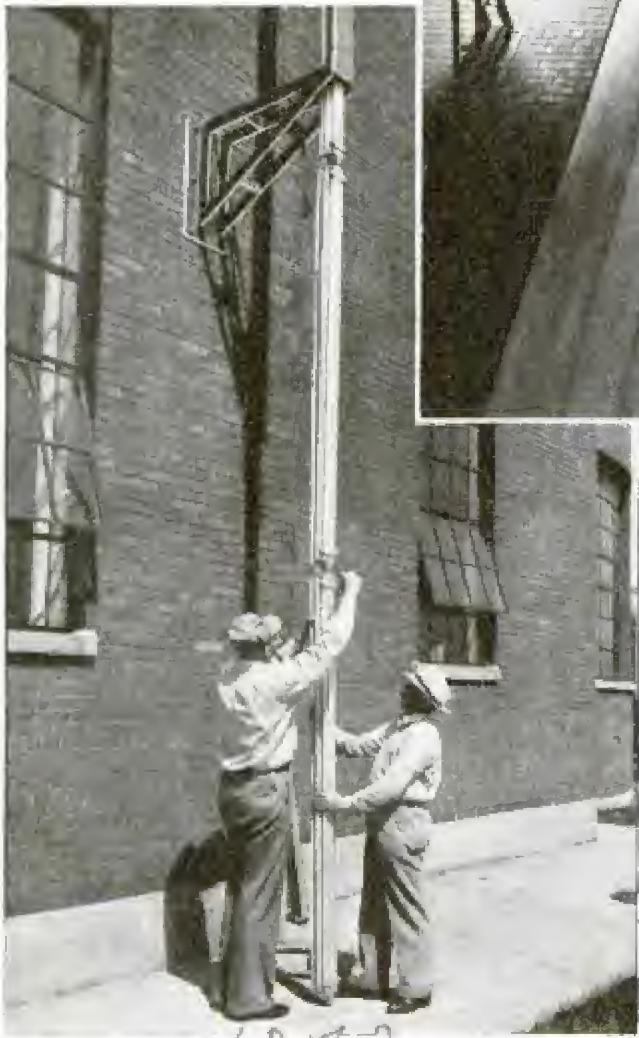
Seven features are combined in a pocket tool that includes a folding razor blade and fingernail file. A screwdriver blade at the tip of the file, a nail cleaner, bottle opener and cigar cutter are included. The tool may be converted into a scraper by inserting the blade crosswise at one end.



171,7925
25 cent
Seven-purpose tool opens easily to take new blade; its many uses are illustrated at sides and bottom

K 877 Floodlights Travel on a Track for Servicing

At right is the facade of a Chicago building made into a pylon of light by fluorescent-tube lamps, which are moved up and down on their tracks by cranks inside the building. Below, connecting one of the seven-foot sections after cleaning. Two sets of three-foot fluorescent tubes are installed in each section



Problems of servicing the fluorescent floodlights that make a Chicago building a 100-foot pylon of light were solved by mounting the tube lamps in seven-foot sections or "cars" on vertical tracks. Each section contains twin sets of three-foot fluorescent tubes, coupled together with removable pins. They are raised and lowered by means of a hand winch inside the building, and as each section comes down within reach of the operator it is disconnected mechanically and electrically and is ready for cleaning or replacement. To facilitate easy starting of the lights during zero weather a ten-watt heating element is installed at the base of each section.

K 872 Uranium Atom U-235 Does Its First Work Starting a Radio Station

The uranium atom U-235, on which scientists focus their hopes for the harnessing of atomic energy, made its debut recently as an actual source of power. The explosive force of a single U-235 atom was put to work starting a chain of electrical re-

actions which turned on the new transmitter of a New England radio station. A sharp click, clearly audible to the radio audience, went on the air as the 200,000,000 electron volts of the split atom switched the program to the new transmitter.

Commencement
Northern Service Old 2. Calley column
nordson, 3500 n. Calley column



TRAINING Your DOG



Left, running-noose collar helps teach dog to obey. Circle, right, Labrador retriever swimming in with duck. Circle, bottom, trainer and two retrievers, a Labrador and a spaniel.

WITH a little effort you may teach your dog to be a useful hunting companion. Retrievers, pointers, setters, spaniels, and some other breeds have the instinct for bird hunting and sometimes a common "mutt" also makes a good hunting dog.

First comes a course in obedience. Your dog won't mind you in the field until he has learned obedience in the yard. From eight to twelve months of age is the best time to start, although an older dog can be taught if you take the time. The dog must be trained every day for half an hour. Keep the pupil cool by working him in the shade, away from distracting influences.

At the gun-dog training quarters of A. H. Asmus & Sons in Bellflower, Calif., bird dogs are taught to sit, to drop game on command, to drop and stay there, walk at your heels, whoa, come to voice or whistle, and retrieve. Ed Asmus, the trainer, says:

"Sternness and force are part of the training system, with praise and petting mixed in. If you lose your temper or are cruel you fail."

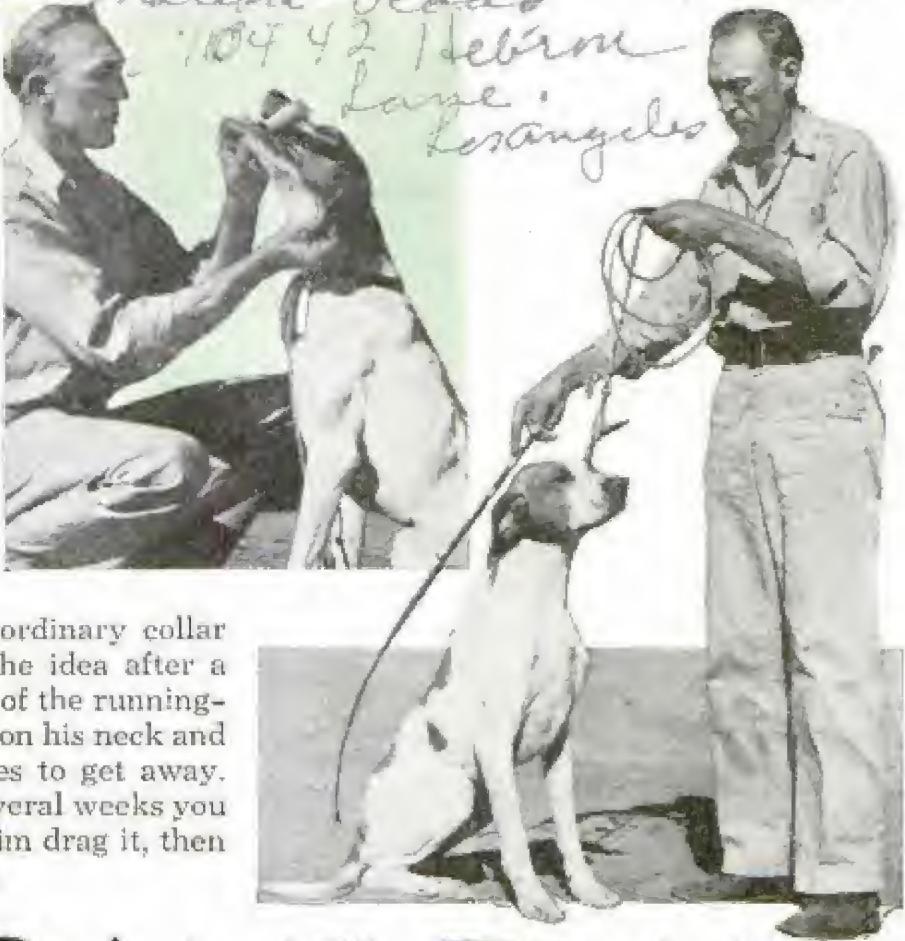
After the pup has learned his name and has become used to a collar and lead he

Col. Thomas S. Slusher Jr.

18618 Matilda Road

X 510

should be taught to heel. That means the dog is to stick close to your left or right side, a little behind you. Use a short lead and keep him in position as you walk around, tapping him on the nose with a switch when he runs forward and jerking him ahead if he drags back. Command him to "heel" every time he tries to get away. Within a week the dog should follow on a loose lead after you have called "heel." If an ordinary collar isn't enough to give him the idea after a few days, use a force collar of the running-noose type that tightens up on his neck and cuts his wind when he tries to get away. It won't hurt him. After several weeks you can drop the lead and let him drag it, then in another week remove it.



for the GAME TRAIL

Top, pinching ear lightly induces dog to open mouth at command "fetch" and hold wooden buck; hold head up, tap hindquarters to teach him to "sit." Lower left, daily grooming promotes good health. Right, teaching dog to drop by forcing collar down and tapping with switch





Left, early step in retrieving. Dog is "dropped" on ground and taught to pick up buck at command "fetch here." Right, tossing feathered buck. Trainer fires cap pistol after dog is executing "fetch here" to prevent gun shyness. Below, hunting dog is taught to sit and hold the game.

At the command "drop" the dog should drop to the ground on all four feet. Start with the sitting position, command "drop," and force his head down with the lead, tapping his shoulders with the switch at the same time. Later on make him "drop and stay there" no matter what distractions there may be.

To teach the dog to come to you, use a short lead at the beginning. Call "come here to me" and use his name, pulling him to you at the same time. Later on graduate to a rope thirty feet long and bring him in with a sharp yank if he doesn't come promptly at command.

The dog should be taught also to come at a whistle; in the field he may range beyond your voice.

"The dog should be letter perfect in all these commands within six weeks or two months," says Asmus. "Always use the same commands. In the last stages of training nearly all dogs need the force collar to prove to them that you mean what you command. As they improve, drop the lead and let it trail and finally remove it, but go back to it if necessary."

While the dog is learning this, teach him also to sit. Command "sit" and hold his head up with the lead while tapping his hindquarters with a switch or pushing them down. Keep his head in the air if he tries to lie down. Next is "sit and stay there." Give the command, walk off a few feet, and if the dog follows, take him back and tell him again to "stay there." Eventually you should be able to go out of sight while the dog sits still.



To teach the dog to stop at the command "whoa," use the long lead and the force collar. Let him break to chase or to retrieve, and just before he hits the end of the rope, command "whoa." The sharp jerk may throw him to the ground, and it won't take many lessons for the command "whoa" to bring him to a stop. Later on you can improve this to "whoa drop" to make the dog drop in his tracks and lie still.

Retrieving is a special art. Many dogs are natural retrievers and pick it up through play, or by being worked with other dogs. Even these, Asmus declares, should be force trained. A natural retriever enjoys his work but does it the way he wishes. Training makes him work more surely.

"A six-inch length of broomstick makes a good object to start with in teaching the dog to hold," Asmus says. "Make him sit and hold the stick, called a buck, in his mouth. Command 'fetch' every time you put it in his mouth. Force him to hold it until you take it away with the command 'give.' After he learns to do this, hold the buck in your hand in front of his face, command 'fetch,' and

Left, dog is pulled in if he fails to come at whistle. Right, teaching dog to hold buck in mouth. Below, in teaching dog to "heel," use short lead to hold him in place and tap him back with switch if he runs ahead



pinch his ear. Pinching his ear or using some other kind of force makes him open his mouth and take the buck. When the dog learns to take the buck from your hand at command, you are ready for the next step. This time he is to take the buck from

(Continued to page 128A)

Floating Garage for Planes Is Launched by U. S. Navy



Sliding down the ways is United States navy's latest seaplane tender equipped with supplies and tools for emergency repairs.

Christened the U.S.S. "Albemarle," after Albemarle Sound, N. C., scene of pioneer aviation experiments, the navy's newest seaplane tender was launched recently at Camden, N. J. Described by the navy as a "floating garage," the ship has quarters for the officers and personnel and will carry supplies as well as tools and machinery for making repairs.

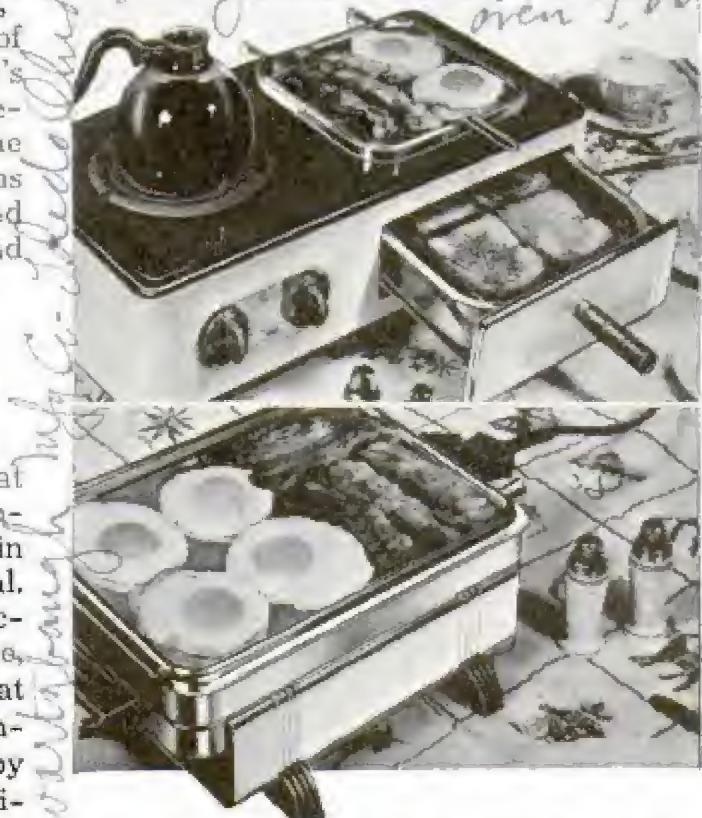
K899 Electric Release Spaces Bombs According to Ground Speed

Giving a series of electrical impulses at a predetermined spacing, a robot bombardier automatically releases bombs in any desired number and at any interval. Just invented, the machine takes into account the ground speed of the airplane, and it is connected simply by plugs so that it can be removed from one plane and installed in another. The time control is by motor, which is connected to a dial indicating the intervals between bombs on a series of concentric circles corresponding

to different ground speeds. The aviator adjusts the motor until the hand points to the desired interval for dropping bombs at the correct ground speed. Then he sets another dial for the number of bombs. Another instrument patented recently by a Czechoslovakian inventor measures the speed of an approaching airplane. The observer sights through the instrument, counts the seconds elapsing while the plane passes between two points on a horizontal index; then the observer plots the altitude—found by another instrument—on the dial and reads the plane's speed.

K283 Tabletop Grill Has Drawer for Broiling Steaks

Two electric grills just offered will cook an entire meal on the dining table. One has interlocking switches that throw up to 1,100 watts into either burner on "high," with proportionate reductions in other positions; there is a hinged removable griddle for grilling, and a broiler drawer accommodating half chickens.



Upper unit has hinged griddle and broiler drawer,
lower, a removable pan for broiling

Beller Magnograph Co.
6638 N. La Brea Blvd., Los Angeles, Calif.

Talking Tape Records Sixteen Sounds in Plane

Hollywood,

Calif.

Planelet.

Right, new device records plane vibrations and observer's voice simultaneously. Below, the recording and control mechanism. Bottom, four typists, or more, can work from same machine at the same time



recording as it does before. There is merely a magnetic field on the tape and this field reproduces the voice or other sound. The machine will record the vibration and noise itself, from which flutter is detected. Alternating or direct current may be used. The message may be played right back, no processing being required as in the case of a film recorder. The control unit has a button for each sound track on the tape and the pilot simply presses as many buttons as there are separate sounds he wishes to record at the same time. If a large plane is tested, sixteen observers may talk into the machine.

Capable of recording sixteen different voices or vibrations at the same time, a "talking" tape machine is expected to simplify and reduce the cost of testing new airplanes. It is particularly useful in one-place planes which have no room for observer or flight test engineer, thus leaving it to the pilot to record all instrument readings and test the plane himself. The quarter-inch steel tape looks the same after the

steady for one hour, telling what they notice about the craft's performance, and the single filling of tape will record 192,000 words. The "talking" tape machine also is expected to find wide usage in business offices as a new means of handling dictation. On a four-track recorder, for instance, four stenographers could take four separate messages or letters simultaneously from the same tape.

Kollman Instrument
Co. 88-88 45th Ave

TRAPPERS of the



K 601.
Encl. Encl. C. J. Schumacher, 108 E 65th St.
New York City

EXPLORERS and scientists have risked their lives in rubber diving suits and cumbersome metal apparatus, in diving bells and other submersible chambers, yet the world beneath the ocean's surface still remains the Great Unknown. Hampered by the apparatus necessary to sustain life under water, the deep-sea explorer until recently was under a tremendous disadvantage in observing marine life, receiving only an occasional clue to the many varieties of creatures that remain unclassified.

When Dr. William Beebe and Otis Barton made their daring descent in the bathysphere a few years ago, they glimpsed indistinctly through its quartz window fish and other large creatures of species entirely unknown. Their glimpses lasted but a short time. Only those compelled by curiosity remained close enough to be observed. Other scientists have had less luck because they could not pursue the finny creatures in their native element.

Pondering this problem, Vincent Palmer, a young scientist, a friend and associate of Dr. Beebe, Max Nohl, Capt. John Craig and other undersea explorers, evolved a



Ultraviolet rays some day may protect divers from sharks (top); probing rocks for lurking sea monsters (center); diver keeping air line from fouling (bottom)

K 601 DEEP



novel theory. Since physical conditions made it impossible for the under-sea explorer to pursue his quarry, that quarry must be lured to him.

On an expedition with Dr. Beebe, he had seen fish attracted by a fluorescent light. Light, he decided, might be the means of trapping the elusive creatures since they displayed positive phototropism—they responded like moths to light. Experimenting with various types of lights, he discovered that when he used an ultraviolet ray, it produced a strange and, in some cases, deadly effect upon fish.

"The fish become fascinated by it," he said. "It literally hypnotizes them as they enter its rays. Brilliant lights attract them from the distance just as blood does a shark. At first there will be a few fish swimming toward the beam, then more and



Circle, small creatures held in light beam. Top, taking pictures after fish have been lured into range by "death ray." Bottom, preliminary dive to look over bottom before setting up light apparatus and camera

R 601

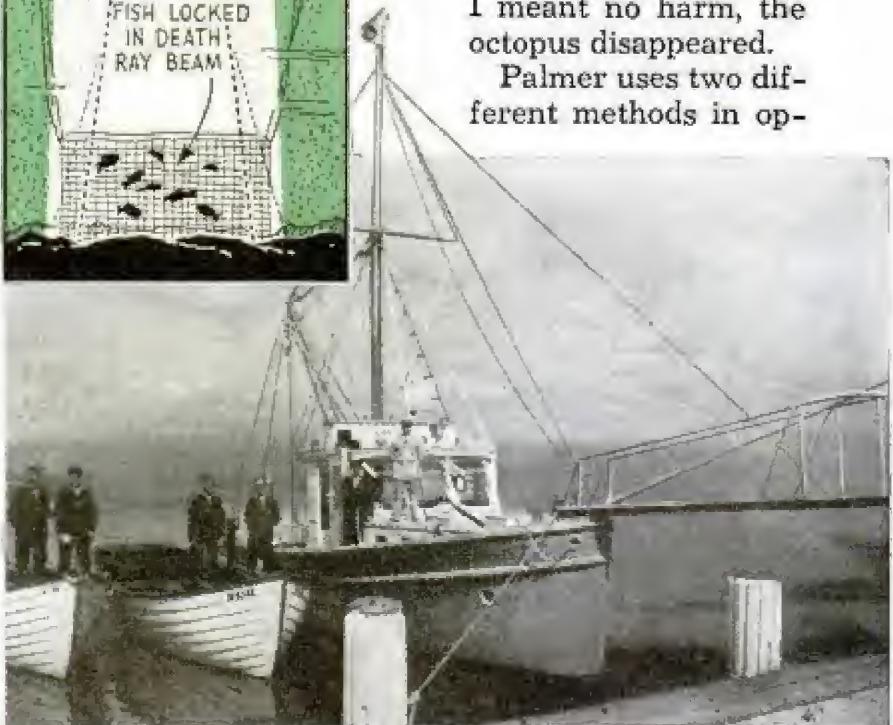
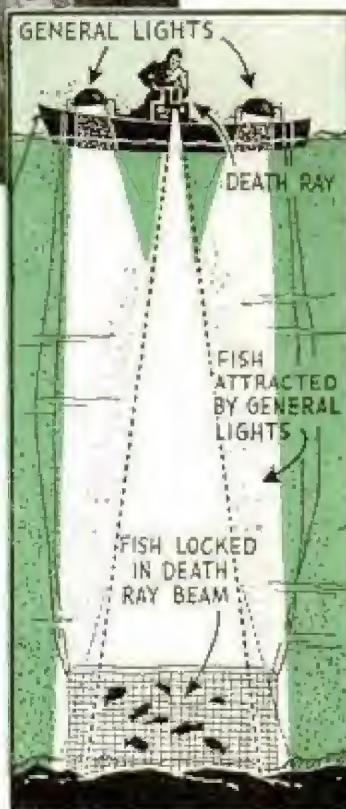


more until there appears to be a whole mass of fish held prisoners within the bounds of the beam."

Palmer used a fluorescent light which projected ultraviolet rays through optical quartz lenses. For this purpose he employed an arc light with very high voltage projecting a beam from twelve to fifteen feet in length, at which distance it is approximately three feet wide.

"The ultraviolet rays, invisible to the human eye, have a toxic effect on the small organisms," said Palmer. "They swim in circles, often rolling over and over as if intoxicated. They seem unable to leave the beam. Shortly they turn belly up and float to the surface. Even larger fish find difficulty in leaving the beam. Their resistance appears to be lowered and they do not seek to escape even when a net is being passed around them."

Once Palmer descended with the light and a motion-picture camera to photograph some small fish. With painstaking care he rigged up the light and set up the camera on its tripod.



Top, directing "death ray" downward in trapping from surface. Center, how ray is used in surface work. Bottom, crew at Marineland, Fla., where Palmer has worked with his ultraviolet light apparatus

Switching on the light, he waited for a few minutes until the small fish were attracted and began to circle in the ultraviolet rays. Suddenly a huge shape flashed through the water, upsetting the camera and sending him sprawling. It attempted to swallow the light.

"It was a porpoise," Palmer said ruefully. "It thought the light was something good to eat. Before it found out differently the light was demolished and I had to build another. This time I made one less tempting in appearance."

On another occasion Palmer was wading out in shallow water with his equipment when a long snakelike arm whipped out of a dark recess. It was the tentacle of a large octopus. Then another and another tentacle slid around him.

"There was no use in fighting," he said. "I knew that an octopus possesses a great deal of curiosity and I was hoping for the best. Slowly the tentacles passed over and around my body as I stood stock still, scarcely daring to breathe. Then it explored the camera, feeling it over carefully. After what seemed an eternity, the tentacles relaxed and then withdrew.

Evidently deciding that I meant no harm, the octopus disappeared.

Palmer uses two different methods in op-



erating his underwater "death ray." The simpler one is from the surface. First a net is lowered to a pre-determined distance. Then two strong lights are turned on, their beams shooting downward from the surface craft. Between these lights, also pointing downward, the ultraviolet death ray is turned on. Then as the fish are held powerless in its beam, the net is raised, imprisoning them and hauling them to the surface.

The second method Palmer uses when exploring beneath the sea or making still or motion pictures. With the aid of his ultraviolet light he is able to film fish in their native element before they succumb to the effects of the ray. In this operation, the ultraviolet light is encased in a small "diving suit" of its own, a device which presented several problems which he had to work out. One was building up sufficient air pressure so that the light would not be crushed like an eggshell when operated at depth. Another was efficient functioning in its diving suit, since the light is

(Continued to page 140A)

601

Left, preparing to set up equipment under water. Right, top, curious porpoises look over the camera. Center, one big fellow upsets camera. Bottom, setting up the photographic equipment under difficult circumstances

Folding Crate to Carry Dog Packs into Small Space



Folded dog crate, left, is carried by its suitcase handle; right, it opens into roomy carrier for dog

Folding into a flat package with suitcase handle for carrying, a crate for carting or shipping dogs is a convenience to dog-show exhibitors and pet owners living in apartments. Screen windows at both sides provide cross ventilation, and positive-acting locks assure rigidity of the crate when unfolded. Weighing only eight pounds, it is made of composition board and covered with imitation leather.

Water Purifier for the Home Fits on Kitchen Wall

Attachable to any water faucet without special plumbing connections, a water purifier



No special plumbing connections are needed for this ozonizer, which "sweetens" water at little cost

(d.m. Clarence G. Aggen. Cincinnati)

*R. W. Sherman Mfg. Co.
Battle Creek, Mich.*
ifier for home use can be installed on the wall over the kitchen sink, plugging into the nearest electric outlet. This ozonizer eliminates objectionable tastes and odors in the water, giving it a clear, sparkling appearance, and destroys some types of bacteria. When the water is running it uses eighteen watts, treating two gallons of water a minute.

Ball-Bearing Washer for Faucet Reduces Wear and Friction

Rotating on a ball bearing, instead of grinding against the faucet seat, a newly developed washer is claimed to last longer. With finger-tip pressure on the valve, the washer cuts off water instantly, eliminating drip.



Filter in Bowl of Smoking Pipe Stops Small Ash Particles

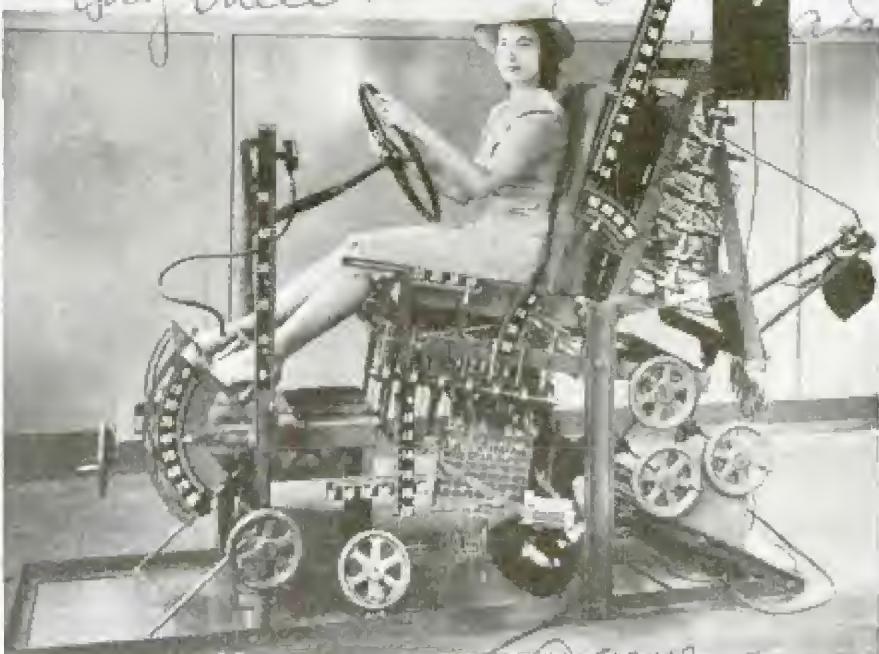


Smoking-pipe filter fits easily into bowl. Inset shows its position when properly installed in pipe

Made of stainless steel that will not rust, a smoking-pipe filter is designed to keep small particles of tobacco and ashes from being drawn through the stem and into the smoker's mouth. It consists of a coiled wire suspended in the bowl, which is claimed to give a cooler smoke and prevent wet waste tobacco infused with nicotine from accumulating in the bowl.

K 786. Ann Arbor, Mich. Test Seat Finds Comfort for Average Driver

Average driving comfort for motorists has been determined with the use of an intricate test seat designed by engineers of University of Michigan. The cushion, seat back and floor-and-toeboard can be moved up or down, forward or back, or tilted at various angles to suit the comfort of any individual. With the subject seated, coil springs in the cushion and back are adjusted individually by levers. When the subject is satisfied that he is most comfortable, a photographic record is made of scales which indicate weight distribution, spring tension and other statistics relating to the test. In 250 such tests the average age of the subjects was 38.5 years, average weight 149.7 pounds, and height five feet

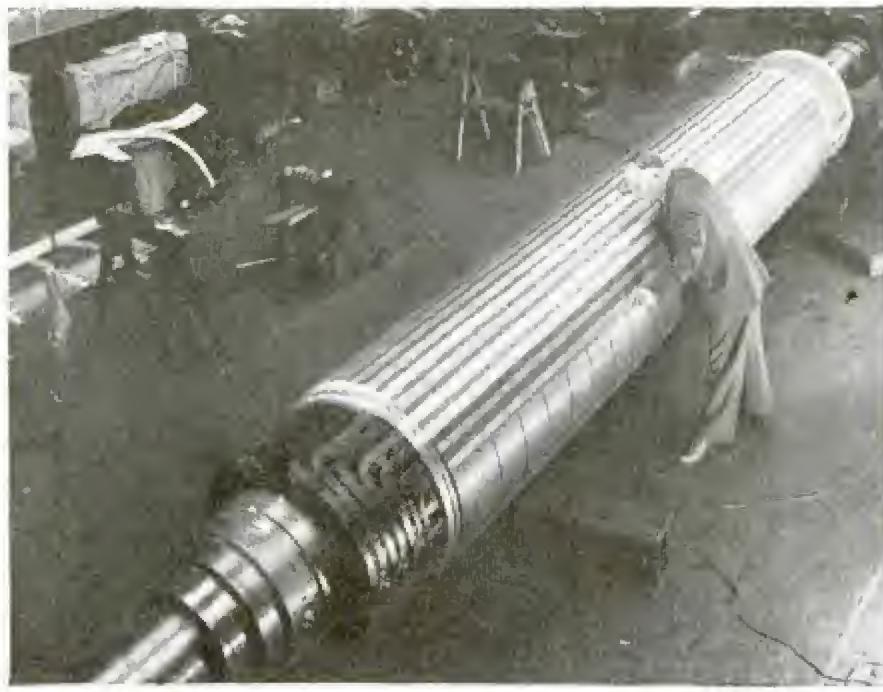


Hugged about with scales, wheels and levers, this robot comfort-testing chair helps find the most satisfactory auto seat for average motorist

and 7.4 inches. This new method of determining seat and back-cushion comfort in cars is expected to aid in attaining a design comfortable to the majority of motorists.

K 797 'Shivering' of Giant Rotor Cured by Letting It Sag Evenly

Engineers found a simple cure for the shivering action set up by a huge rotor when it reached a speed of 3,600 revolutions per minute. The cause was traced to



It looks straight enough here, but this rotor sags about 15/1,000 inch. Crosswise slots in solid portion permit constant sag while it is running

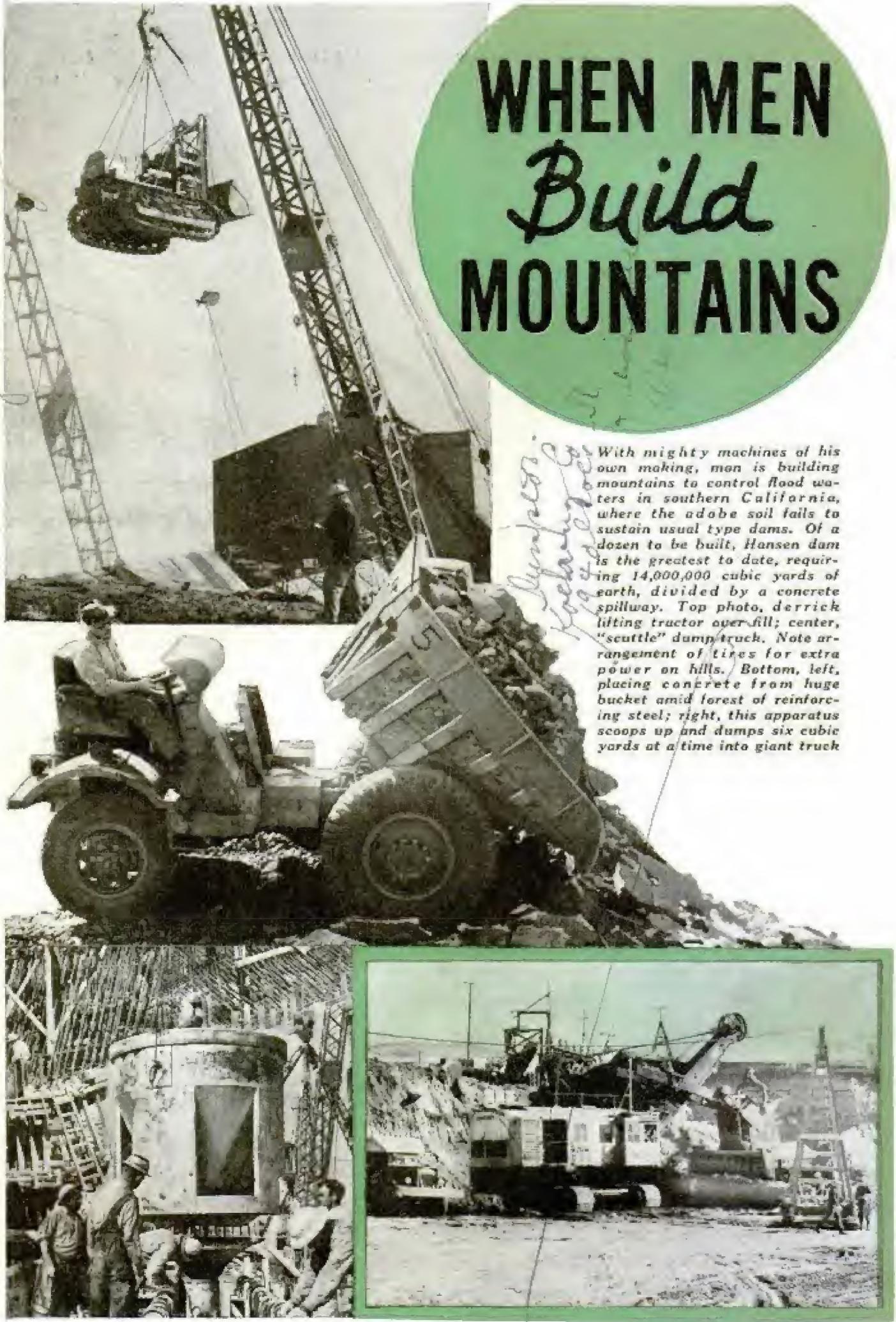
longitudinal grooves which were cut on two sides of the rotor to permit the insertion of the windings. Each time these grooves were in top and bottom positions the rotor would sag, which happened twice for each revolution. Instead of trying to stiffen the rotor, it was decided to make it sag evenly throughout its revolution. This was accomplished by cutting crosswise slots in the solid portions of the rotor, between the grooved regions, thus giving it the desired flexibility.

Stamped, self-addressed envelope, sent to our Bureau of Information, will bring you the name and address of the maker of any article described in Popular Mechanics.

Conf. Marchael Berhage, 11/28 'Stearns. Univ.
Los Angeles. Calif. 90024

R 670

WHEN MEN *Build* MOUNTAINS



Sargent & Sons

R 6 70

Nov 6 1940

Swansea
Calif



Top, called a "dragveyor," this monster pours a steady stream of earth into truck by means of a conveyor belt, a power shovel and drag line keeping supply going. Circle, gigantic scraper, coupled to a 160-horsepower Diesel engine on two wheels, picks up twenty-five cubic yards with ease. This revolutionary earth mover, known as a Tournapull, can do the work of 300 horse-drawn wagons like the one shown at right in the picture

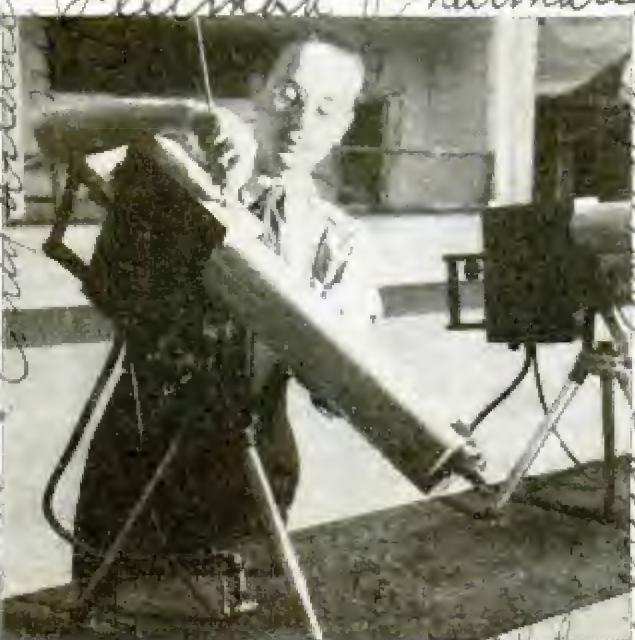
Panamax Excavator
South Milwaukee, Wis.



Officer in signal tower, above, directs traffic at crossing to prevent other vehicles from being run down by speeding Tournapull which travels forty miles per hour on level ground. Right, tractors at front and rear help load Tournapull; rear tractor's function is obvious from its name, "billygoat"



Target-Range Machine Gun Uses Air-Rifle Shot



These air-pressure machine guns in a Coney Island shooting gallery fire at toy planes and parachutists.

Clay pigeons have been outmoded by toy parachutists and tiny airplanes at Coney Island's new shooting gallery where a machine gun has replaced repeating rifles. Air-rifle shots instead of real bullets are fired by air pressure, and the gun keeps firing until the trigger is released. One loading consists of a hundred shots.

Tools for Marking Tires or Wood Have Movable Letters

Branding irons are used by operators of large truck fleets to mark the tires for identification, and to facilitate records of



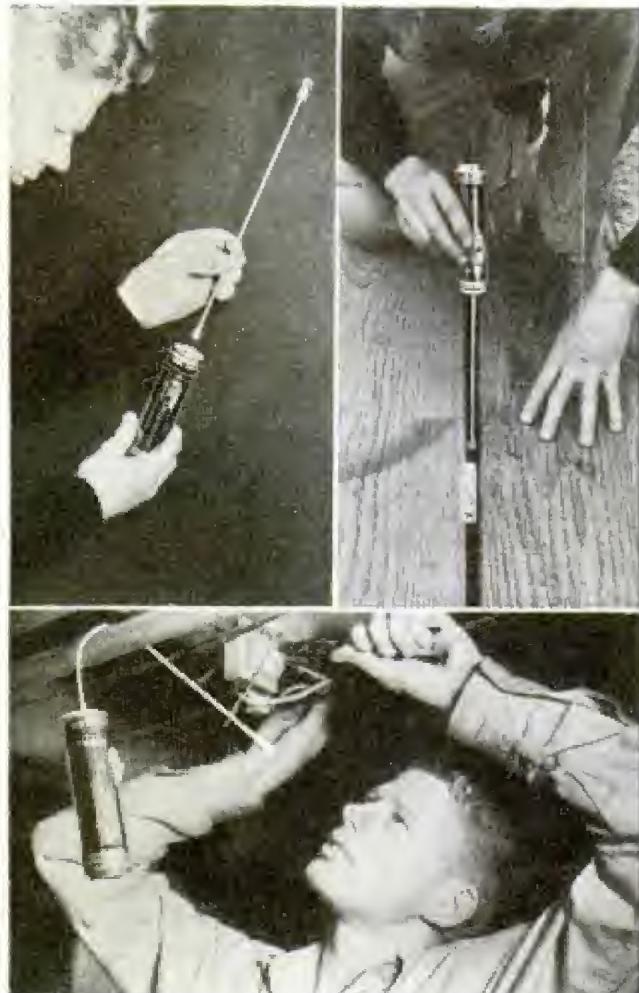
Above is the gasoline-burning tool branding a tire; below, the electrically heated marker

tire mileage. The irons have interchangeable letters and numbers, which are heated in one unit by a gasoline burner and in another by plugging in an electric heating element. The branding irons can be used also for marking lumber, crates, barrels, tool handles, etc.

K 769

Flashlight Bulb Extension Rod Can Bend around Corners

Light from a flashlight can be spotted closely in hard-to-get-at places with an extension arm capable of bending and small enough to enter openings seven-sixteenths inch diameter and other places a flashlight cannot reach. Made of special wire encased in aluminum alloy tubing,



Screwed into the flashlight socket, the extension lamp lights up work at inaccessible spots

the extension has a flashlight plug at one end and a socket for the bulb at the other. Around the house it is handy for locating lost articles and for making repairs, while for mechanics it has unlimited uses such as inspecting gears, lathe bores, inside of molds, automotive engines, brakes, and all sorts of intricate mechanism.

Machine Exercises Eyes to Correct Defects

Certain weaknesses of the eyes can be treated with an electric machine just developed. The patient looks into a darkened field in which moving prisms give flashing lights the effect of motion. As the eyes follow these flashes, the optical muscles obtain healthful exercise.

*M.C.
Pl.*
At the right is the "gymnasium" for the eyes. By following moving lights in its darkened field the eye muscles are strengthened and certain weaknesses may be corrected



Mirror over Bowling Alley Helps Player Detect Faults



Bowlers are aided in improving their scores by a mirror suspended eight to ten feet from the foul line. This is the approximate spot where the player's eyes should be focused, so when he delivers the ball it is possible for him to study his own form and try to correct any faults he sees.

Mirror above alley at the point where bowler's eyes should be focused, the mirror reflects player's form

Armored Mobile Sound Studio Makes War Records for Broadcast

Housed in an armored truck, a sound-recording unit designed to operate in the war zone under severe conditions has been tested by the Canadian armed forces. The traveling studio is equipped to record activities of the Canadian troops at the front for later broadcast by short-wave radio to Canada. A crew of five, with an engineer in charge, operates the truck.

Canadian activities at front are recorded by this truck for broadcast by radio to the folks at home



FOILING the GOLD



"YES, sirree!" nodded the bewhiskered prospector, sizing up the prosperous stranger. "This gravel runs plenty high in gold. I wouldn't sell this claim if I didn't need money right away. Here, pan a little and see for yourself."

He dumped a shovelful into a gold pan, scooped up a little water, and handed the pan to the visitor, who swirled it rapidly, washing the coarse material out. Fat yellow specks gleamed from the concentrate in the bottom.

"Looks like gold," agreed the stranger. "I'll buy your claim if it runs high enough to pay—but you'll have to let me take a sample for assay."

"Sure thing," the prospector assented. He shoveled together a pile of gravel, divided it into quarters, then discarded two of them. The balance he heaped up and quartered again, repeating the mixing and quartering until finally the stranger took away a paper bag full of the remainder.

When he called at his assayer's for the report, he was sum-

moned into the laboratory. "This stuff ran so high I could hardly believe it," said the assayer. "Take a look."

He dropped a tiny pinch of gold dust onto a glass slide and slipped it under a microscope. The other peered, saw the tiny grains magnified to the size of boulders. But unlike boulders, they were jagged. Across many of them ran deep scratches.

"Did you ever see any square-cornered gold dust from a river bed?" demand-



Slicing thin section of rock on diamond-studded wheel. Top, examining ore under petrographic microscope to study the appearance of individual grains and, right, gold dust being rolled in cigarette

K484

SWINDLERS



ed the assayer. Placer gold rolls among the pebbles as it is carried downstream and soon gets rounded and smoothed. Notice those file marks. Somebody must have improved this sample with a little gold dust—from a watch case or a ring, probably."

The miner grew indignant when



Top, photographing spot where samples have been taken, a safeguard against salting. Center, false rivet in shovel handle allows gold dust to drop into gravel. Bottom, needling gold solution into sample bag

accused of trying to salt his claim, but the prospective buyer suddenly grabbed the shovel used in quartering the sample. He examined it and learned the miner's secret. When turned a certain direction, the hollow handle lined up two holes to release the hidden gold dust it contained—"sweetening" the sample to bonanza richness.

Thirty-five-dollar gold has made suckers even more eager than in the old days—but modern laboratory magic



now gives them a better break. During the early gold rushes, the sound of a shotgun often meant that salters were firing gold-laden cartridges at the face of a drift where samples were to be taken. Today, a look with the petrographic microscope would quickly show the assayer how the gold particles had been flattened against the rock by the blast, like falling raindrops. And a spectrographic examination of the sample might even reveal remnants of the powder used in the shell.

Carelessly flicking the ash from his cigarette as he picked off chunks of ore, an old-time salter could easily load the samples with gold dust. An ordinary, roll-your-own cigarette can be loaded with 200

milligrams or so of gold, enough to make the assay show sensational values. But again the microscope betrays the true character of the grains. If polished from rolling in a stream bed, they would be out of place in a hard-rock mine where the ore must be picked or blasted from solid quartz.

Modern "snapshot" assaying quickly gives so clear a picture of an unknown rock's composition, that it's foolish to guess. The old time-tried fire assay method still is standard for measuring the exact amount of gold or silver in a specimen—but often the unknown piece of rock has small amounts of impurities which give strong hints as to its origin. It's easy enough, now, to determine all the minerals

present in a sample without the long series of intricate chemical tests that used to require many days.

Just pulverize the chunk with mortar and pestle; mix well, then put a pinch about the size of a pea into the spectrographic arc. The arc flares out to



Top, spraying gold solution onto rock to salt sample. Center, assayer tagging pans containing parts of samples which have been assayed. Bottom, hole down center of this drilling bit lets gold dust fall out

make a snapshot upon a strip of movie film. When the assayer puts it side by side with a master film, he can call the roll of the metals simply by comparing black bars on the negative. A machine like that costs \$3,000, but the assayer can give you a complete, all-mineral assay, sensitive to one part in 100,000. That's a quick but accurate way of sizing up suspicious-looking assays and is well worth while because it may reveal unsuspected rare minerals overlooked in the conventional assay.

Gold, wherever you find it, looks much the same to the eye—but not to the spectrograph. Perhaps a rare element, one part in 50,000, may show up in a specimen; but if some samples from a mine betray the rare "impurity" while others do not, you had better take a fresh batch of samples.

When promoters tried to interest a wealthy man in a mercury mine, they produced samples which by ordinary methods showed plenty of mercury. But the buyer, equally shrewd, brought the sample into the laboratory. The spectrograph showed the mercury to be mercuric chloride—better known as ordinary drug-store calomel.

Precision instruments for scientific ore analysis now make every piece of rock reveal individual earmarks. Two ores may assay exactly the same in gold, yet they may be put together differently. If a question arises, the assayer can saw a thin section of rock, cement it to a rotating, lathe-like affair, and grind it down thinner than paper. Under a petrographic microscope and illuminated by a strong light from beneath, it becomes quite transparent. The smallest grains of metal stand out clearly in their "matrix" of common rock. Hardly any two ores look alike under this test, and a rock tossed in by the salter stands out clearly.

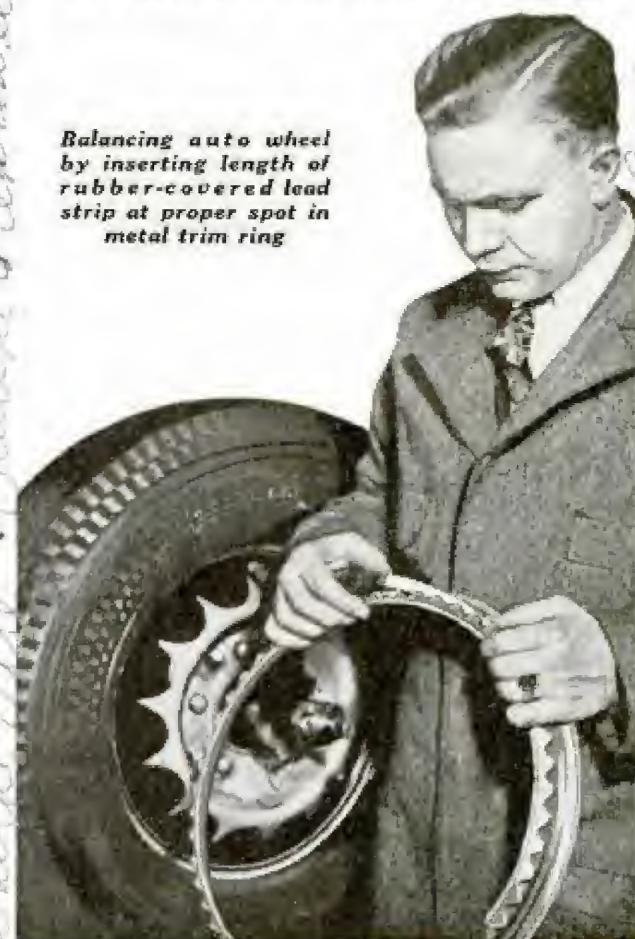
Much information can be read from the way individual grains look. An expert at reading the life story of a grain of gold by eagle-eyed microscopic study knows that big, rough particles probably didn't travel far from the original lode. Small, well-rounded grains, on the other hand, have been battered over many a pebble. If the two are mixed, it may mean that the mine has two dissimilar veins furnishing gold—or it may mean salting.

The fineness or purity of gold is another guiding point. Natural gold runs from fifty to ninety-nine per cent pure, and if two samples, supposedly from the same mine,

(Continued to page 126A)

Lead Strip to Balance Wheel Is Hidden in Metal Ring

*Balancing auto wheel
by inserting length of
rubber-covered lead
strip at proper spot in
metal trim ring*



Rubber-covered lead strips are employed for balancing automobile wheels in a system just introduced. Supplied to the automotive trade in continuous strips wound on a steel reel and marked in one-ounce lengths, the strips can be cut off easily to the exact length needed for proper balance, and then inserted in the metal trim rings with which most de luxe cars are equipped. Thus concealed they do not detract from the car's appearance and are just as efficient as when attached to the rim of the wheel itself.

1838. Pill Box Snaps Open at a Touch

No more fingernails need be broken trying to pry open the little tin pill boxes in which such medicinal tablets as aspirin are sold. A new style pill box snaps open when you press the back of the lid.



Single-Wheel Roller Skate Useful on Rough Surface



These roller skates for the rural dweller are provided with stirrups and leg braces

Roller skating is made practical for people who live where there are no sidewalks or paved roads by the invention of "land" skates which are designed for use in the country. Each skate has a single large wheel and a stirrup in which the skater places his foot. Additional support is provided by a leg brace.

Indicator Showing Ground Speed Aids Pilot Flying Blind

Secret development of an instrument that shows the exact ground speed of an airplane promises to be a great aid to navigation in thick weather. Independent of winds and drift, the pilot would know at all times how fast he is covering ground and could figure his position and arrival

time accurately without the intricate calculations now necessary. A bombing plane could take off in dense fog, and with knowledge of the ground speed could drop bombs when the instrument indicated the objective had been reached. An U. S. army officer invented the device. Little is known except that it operates on the electric induction from the earth's magnetic field and thus far has shown ground speeds accurately up to 300 miles an hour. It is reported that the instrument can be applied to a map so that a needle would travel over the map and show the position of the plane constantly. It may be used on boats as well as aircraft.

Car with a Two-Pedal Drive Is Operated by One Foot

Necessity again proved the mother of invention when a Chrysler automobile executive suffered a broken leg, and, to drive his car, had the clutch pedal removed. The clutch and brake were made integral so far, as initial operation was concerned. Press-



Top, brake pedal releases clutch and operates brake; below, button on gearshift lever operates clutch

ing on the conventional brake pedal released the clutch and operated the brake in the usual manner. Thus one foot could do all the work, operating clutch and brake with one pedal and the accelerator with the other. In another Chrysler built for one-foot driving, the foot-operated clutch was eliminated and a vacuum-control button installed on the gearshift lever to disengage the clutch at a touch.

1653

Self-Service Roadside Stand Sells Honey to Motorists

Finding that he had tons of honey on hand without a market for it, a bee raiser in Minnesota erected a roadside stand where customers may help themselves, placing their money in an open earthen pot. This "honeyteria" brings in about \$100 a month during the late summer and fall. Loss by theft averages less than three per cent. Tourists slow up when they see live bees flying through a hole in a signboard with a beehive painted in front. Upon examination they find there is a real hive set flush against the back of the board, but before they have a chance to pick up speed, the honeyteria comes into view.



Attracted by a roadside beehive, a tourist stops to make a purchase on the "honor system"

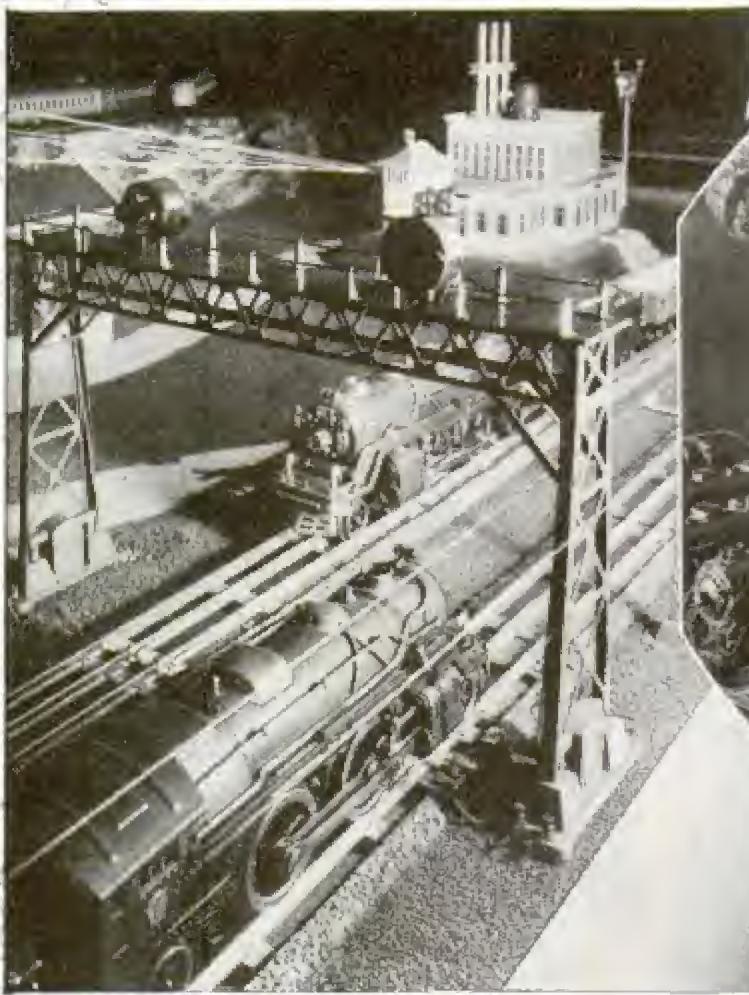
Three-Seat Twin Bicycle Is Motor-Driven



When the engine of this three-seater runs out of gasoline, there are three sets of pedals and you can do your own work

Two bicycles joined side by side with an ingenious arrangement of angle iron and braces is a vehicle built for three. The third rider occupies a seat placed between the two bikes. Driven by a washing-machine type engine, its inventor claims it has a top speed of fifteen to twenty miles an hour and runs seventy-five miles on a gallon of gasoline. Throttle control is on the handle bars of the left-hand bicycle, which is the driver's side, and the clutch can be reached easily from the rear. Three sets of pedals permit any one or all three of the riders to pedal the cycle if it runs out of gas or the motor breaks down.

There are 9,500 books on electricity in the New York Public Library, and only 7,000 on astronomy, a science thousands of years old; but mining and metallurgy are represented by more than 12,000 volumes.



New models, at left, run hour after hour in tests to find possible defects; above, making final adjustments at end of assembly line. Below, left, applying handrails to tank cars; right, queer-looking machine winds armatures

MODEL TRAINS on the

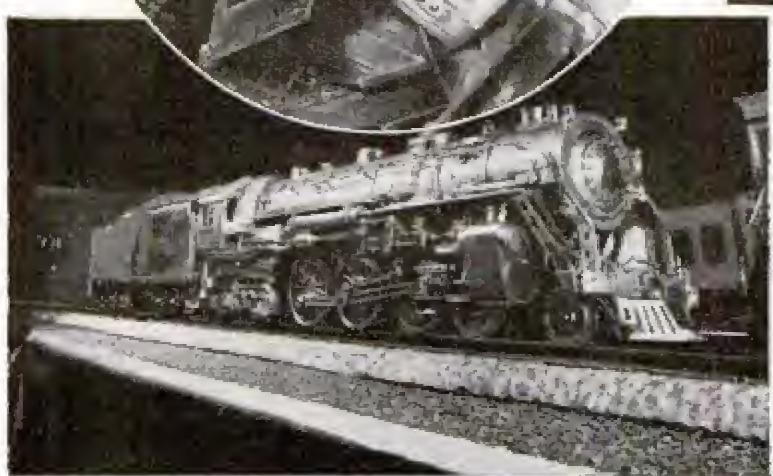


Model Cars 15 & 26th Street New York
 Geared at high speed to meet demands of model railroaders and purchasers of toy trains, production lines in miniature railroad factories, as complete and efficient as those of large automobile plants, now turn out in one year 550,000 tiny locomotives, 1,650,000 cars and more than 5,000,000 feet of track. About ninety per cent of this is sold in the month preceding Christmas

K-597



PRODUCTION LINE



Top of page, designers and engineers at Lionel Corporation watch working model of new design make test run; in circle, first rough casts of top and bottom of locomotive. Bottom, left, scale model of New York Central Hudson type; right, trays of newly painted locomotive tops and caboose roofs emerging from the "baking" tunnel



Lifesaving Overcoat Will Support Four Men



Here's a seagoing overcoat you need not hang on a hickory limb, for it's more buoyant than cork and will keep you afloat more than three days. Left, jumping overboard for a demonstration; below, afloat in the jacket. Developed in England, it is lined with a super-buoyant material and need not be inflated

Four men can be supported in the sea by a lifesaving jacket claimed to have a buoyancy six times that of cork. Introduced in England, the coat, which needs no inflation, will keep its wearer afloat more than seventy-two hours. It derives its buoyancy from a patented fabric lining woven with a material called "Rapok." Finished in gabardine, the garment is lighter in weight, but warmer than the present service coat which it may replace for duty on water.



Lightweight Boat Made of Plastic Molded in One Piece

Seamless construction, light weight, smooth interior, easy to keep clean and



Molded plastic boat resists weather and corrosion

less danger of leakage are advantages claimed for a small boat made of plastic cast in one piece, with reinforced stem and transom. Tests indicate that the material is hardy enough to weather snow, sleet, wind, salt and fresh water, and even the desert sun. Its light weight makes it especially useful as an auxiliary boat that must be taken aboard a larger craft or kept on the beach while it is not in actual use.

Radio Marks an "X" on Map to Show Pilot His Position

Carrying the automatic direction-finder a step further, an inventor has developed a radio device that traces two white lines on

*Boys from S. Sebring.
Balacon Pa.*

a map. The point where they cross is the pilot's position. Two radio receivers in the plane tune in two stations on a rotating loop antenna. The receivers control two beams of cathode rays in a vacuum tube, and as the beams oscillate they trace two lines on a screen similar to that of the television receiver. The direction of these lines is fixed by the bearings of the stations tuned in. A projector throws a map on the same screen, and thus the pilot sees the map with the two lines superimposed. The map and screen are kept oriented, regardless of the direction of flight, by a gyrocompass which rotates the entire indicating mechanism. Thus, for example, north would be kept at the top at all times.

7,000-Foot Bridge to Island Replaces Oldest U. S. Ferry



View from seaplane shows the new Jamestown bridge linking Rhode Island shore with Conanicut Island. It replaced a ferry operated since 1675

America's oldest transportation line, the Jamestown-Saunders town ferry which has operated continuously since its founding in 1675 by Gov. Caleb Carr, has been supplanted by a \$3,000,000 bridge connecting the Rhode Island mainland with Conanicut island, on which Jamestown is located. The 6,982-foot span crosses the west channel of Narragansett Bay and eliminates a forty-five minute ferry trip.

X621 Radio "Lighthouse" Spins Signal to Guide Pilot on Course

Five metal rods only two feet long form the antenna system of a radio "super-

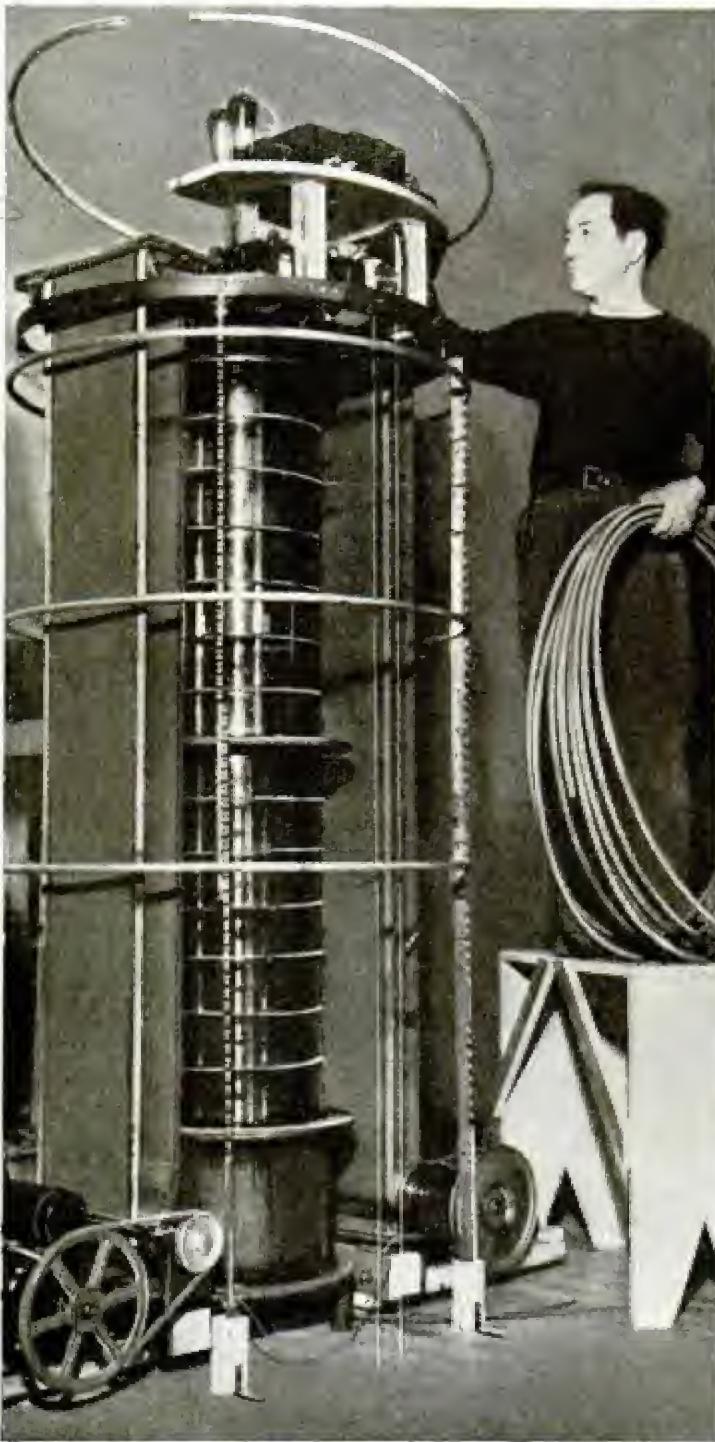


These small rods may replace the 125-foot pole antenna now used for transmitting radio range signals

"lighthouse" just developed to guide airplanes to port without regard to any fixed courses between cities. Thus the air pilot who has wandered far off the conventional radio beam, indicated at present by a fixed tone in his earphones, can learn his course by a glance at a dial in the cockpit. The system works like a lighthouse sending out two beams, one which sweeps around steadily sixty times per second, and the other sending out a flash in all directions every time the rotating beam points north. By timing automatically the interval between reception of the flash and the sweeping beam, the exact direction of the lighthouse from the plane is indicated. On the dial the pilot watches a marker in a ring of light; if the marker stays in one position the flier is on his course; if he moves off course, the drift of the marker shows him the direction to return to his course. The simple antenna system of five twenty-four-inch rods eliminates the large system of 125-foot poles spaced 600 feet apart, forming the present long-wave radio range systems now in use.

K 419

EXPLORING *the*



Left, placing protective aluminum rings around traveling belts of electrostatic generator. In circle is the anti-corona shield at top of tall vacuum tube; below, looking through glass slide into cloud chamber where sub-atomic particles leave their tracks when shot through

INSIDE a protective wire cage in the high-tension laboratory of the California Institute of Technology an engineer pressed a foot switch and there was a blinding flash. A tremendous noise shook the building.

Two million volts from a lightning generator had been discharged into a giant vacuum tube.

Within a concrete room that housed the

base of the tube a weird violet-hued ray glowed in the dark. A stream of wild electrons shooting out of the base of the tube had momentarily excited the air molecules.

Shoot the electrons into a transparent Bakelite target and the target breaks down inside. The electrons enter the target at such high speed that the surface is untouched yet inside, where they slow down enough to become destructive, a strange

X419 HEART of the ATOM

branchlike pattern is made. A slab of glass used as a target below the electron tube is discolored by the speeding particles. Calcite crystals, bombarded by the electrons, radiate golden light for minutes afterward.

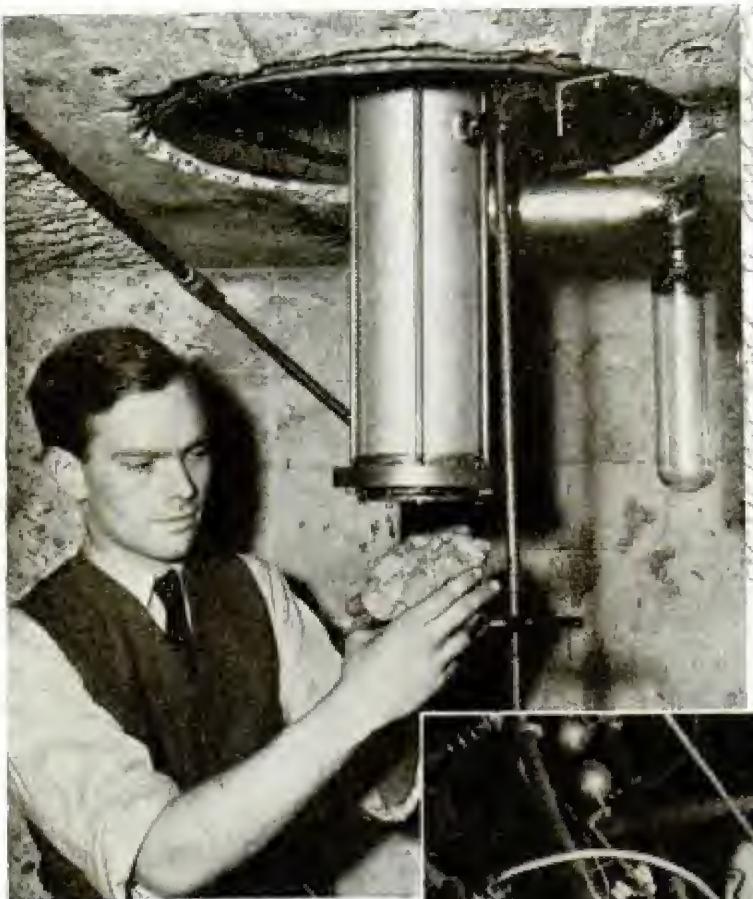
The nine-foot vacuum tube, built up of porcelain rings, is being investigated by Dr. Arno Brasch to determine its value in atomic research. An intensive campaign to rob the atom of its mysteries is being conducted in a score of research centers. Though much has been learned about the atom, many perplexing questions remain unsolved.

Scientists visualize the atom as a tiny solar system, having a nucleus that consists of neutral particles of energy called neutrons and a number of positively charged protons. Around this nucleus revolve electrons that balance the charge of the protons. Smash the nucleus apart or remove some of its neutrons and the atom becomes an atom of a different



Metal balls, top, form spark gap for measuring voltage of 2,000,-000-volt surge generator for atomic research. Left, bank of condensers for "lightning" generator. Right, huge transformer producing high potentials





Above, calcite crystals held under aluminum "window" at foot of vacuum tube are made to glow under electron radiation from tube. Right, closeup of condensers. Bottom, nine-foot vacuum tube

element. Often the new material is unstable and is radioactive for a time.

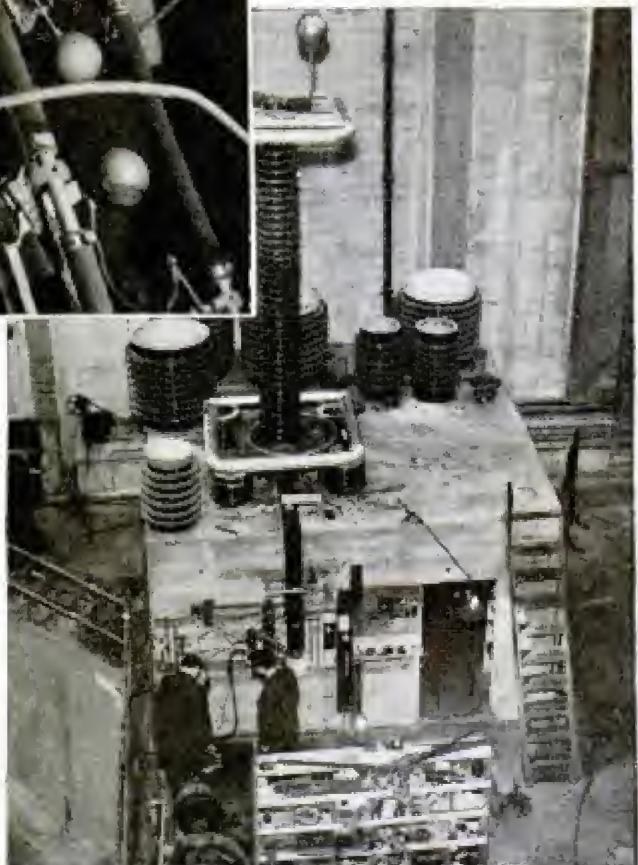
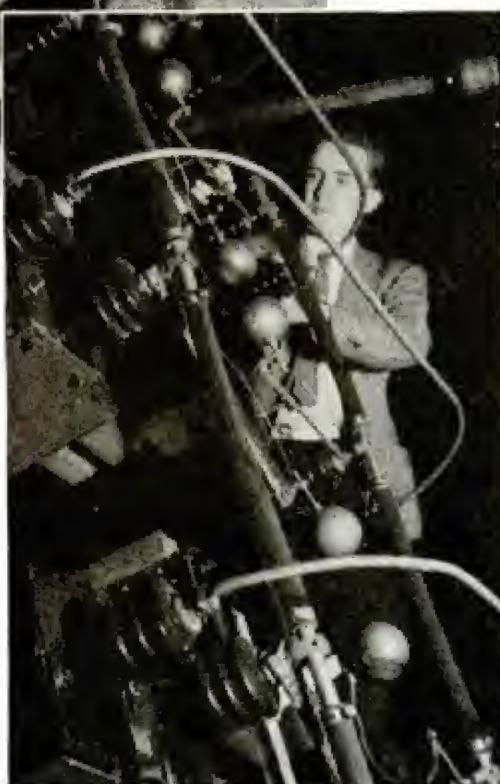
Physicists have been transmuting elements for years, but by the atom instead of by the pound. All but two of the ninety-two known elements have been transformed into other elements of lower atomic weights although usually in sub-microscopic amounts. The physicists are much more interested in learning more about the mechanics of transmutation, in the energy that is released, or in some of the things that fly off from disintegrating atoms, when they are smashed, than in merely changing one material into another.

To break atoms up, the scientists use particles of energy that they strip from other atoms. In some cases neutrons are used, in other cases protons. Deuterons, the nuclei of heavy hydrogen atoms, are also used. Recently for the first time in atomic research electrons were employed

as bullets, the electrons smashing up beryllium atoms into two atoms of helium and one spare neutron.

An atom is tied firmly together by some sort of mysterious "cosmic glue" and the atom bullets must have tremendous speed or energy to break them up. This is the reason why the big electrical machines used in atomic research have been built. The cyclotron whirls its missiles around in an alternating magnetic field until they attain high velocity. A new kind of atom smasher at Cornell uses a short-wave radio generator to accelerate sub-atomic projectiles in a straight line inside an eight-foot horizontal vacuum tube. The electrostatic

generator, such as Westinghouse's huge pear-shaped four-million-volt atom smasher, produces high voltages that impart terrific speed to the particles being used to bombard atoms. It is estimated that, depending on the kind of particle used and the voltage, speeds of from 10,000 miles per



second to nearly the speed of light are attained by the flying particles.

When an atom is torn apart tiny bits of sub-atomic energy are often set free. These include protons, alpha particles, gamma rays, negative electrons, positive electrons, and negative and positive electrons in pairs. Such stray bits of energy are being studied by means of cloud chambers, ionization chambers, linear amplifiers, and electroscopes. Passing through the saturated atmosphere of a cloud chamber, for instance, a speeding particle ionizes the air and leaves a track that can be seen or photographed. Emission of an alpha particle from a disintegrating atom is often determined by placing an unexposed photographic plate in its path. The alpha particle exposes a few grains of emulsion in passing through the plate and these can be examined through a microscope.

One of the fields being investigated at California Tech. is the critical voltage needed to give a particle exactly the right speed to disintegrate its atomic target. Using an electrostatic generator to energize the particles, Dr. C. C. Lauritsen and others are hurling various particles at different speeds at a variety of atomic targets, charting the speed each kind of particle needs to break into the atoms under bombardment.

Studies of electrons have vastly increased the competence of X-ray machines, the radio, and telephony in the last decade.

Unstable elements that are radioactive, created in the laboratories, are being used as "tracer" materials for studying biological processes, both in animals and plants. At the University of California Prof. Ernest O. Lawrence has been using his cyclotron to create streams of particles destructive to cancerous tissue. It was found that neutrons slowed down by a thick block of paraffin are several times more effective against cancer than fast neutrons that had already shown promise.

At some research centers a concerted drive is being made in splitting heavy atoms and studying the effects. Research on the heavy atoms has been stimulated by experiments that suggest the possibility of harnessing atomic power. The enormous release of energy that occurs when uranium atoms are broken up, and the apparent chain reaction that seems to make disintegration continuous once it has been

(Continued to page 122A)

"Good Temper" Spectacles Fad in War-Wearied Land

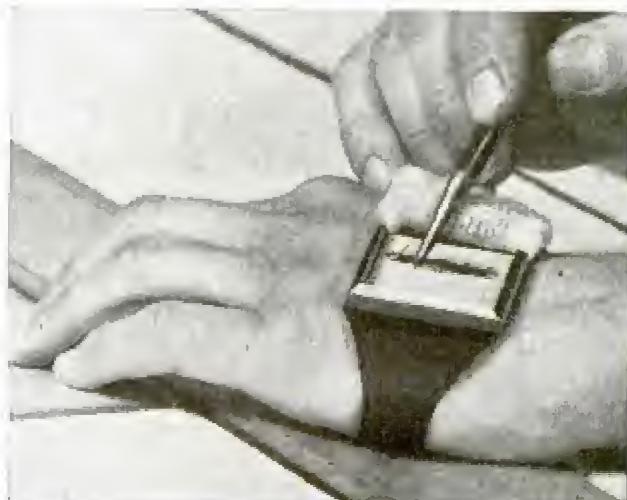


Latest wartime fad in Europe keeps eyes focused on smiling faces of movie stars instead of war bulletins

Looking at pictures of the smiling faces of movie stars, instead of at bad news from the war front, helps some Europeans keep up their spirits while nations are at strife. Mounted in a frame that fits on ordinary spectacles, the pictures are held at a suitable distance for viewing.

~~K674~~ Pencil Pointer Worn on Wrist Is Handy for Draftsmen

For convenience of artists and draftsmen in keeping pencil points sharp for doing fine line work, a pencil pointer worn like a wrist watch is now available. Always within easy reach, the pointer consists of a sandpaper holder and cleaning pad.



Only a few strokes of lead across pencil pointer strapped to wrist are needed to grind a fine point

Smooth-Riding Aquaplane Stabilized by "W" Hull



Shaped by steam-bending lengths of mahogany and spruce, this aquaplane rides more smoothly

Making radical changes in the under-gearing of a new aquaplane, a Canadian athlete and a California engineer have designed a new board embodying a triple combination of safety features. The bow is of conventional U-shape, but as it draws toward the stern the hull gradually changes to a W-shape, serving to make the board cushion in rough water. A series of

fore and aft steps allow it to follow a racing speedboat in direct line. These changes in design, wrought by steam-bending lengths of three-quarter-inch mahogany and spruce, alternated, reduce the aquaplane's tendency to pound, pitch and upset the rider in a rough sea. The board measures seventy-one inches long and thirty inches wide, has a two and one-half inch draft, and weighs sixty-four and a half pounds.

Six-Ton Hammer Does Work of Twenty-Six Ton Unit

Equipped with a rising anvil, a six-ton drop hammer does the work of a hammer of twenty-six tons. The anvil operates at the same speed as the falling hammer, thus utilizing the full energy of the impact. Both units return to operating position after the blow, resulting in shockless, vibrationless operation.

Portable Electric Water Heater Holds Two Gallons

Two-gallon electric water heaters that can be installed in the kitchen or bathroom or even in the farmer's barn supply an inexpensive service where a small amount of hot water is needed. Handy for shaving, for making hot drinks, or for preparing livestock feed, these heaters are being used also in barber shops, roadside stands and tourist homes.

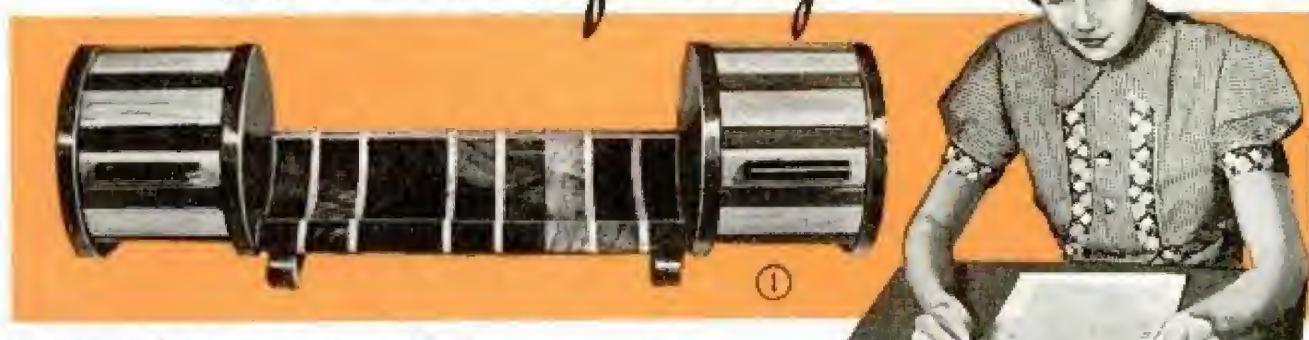


Mounted conveniently in a kitchen, this small electric heater supplies hot water at small cost



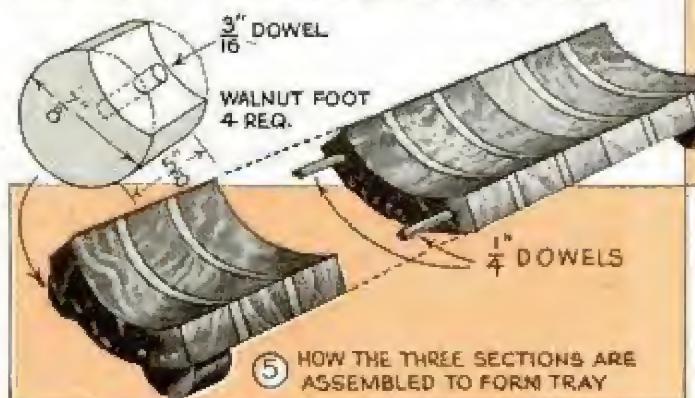
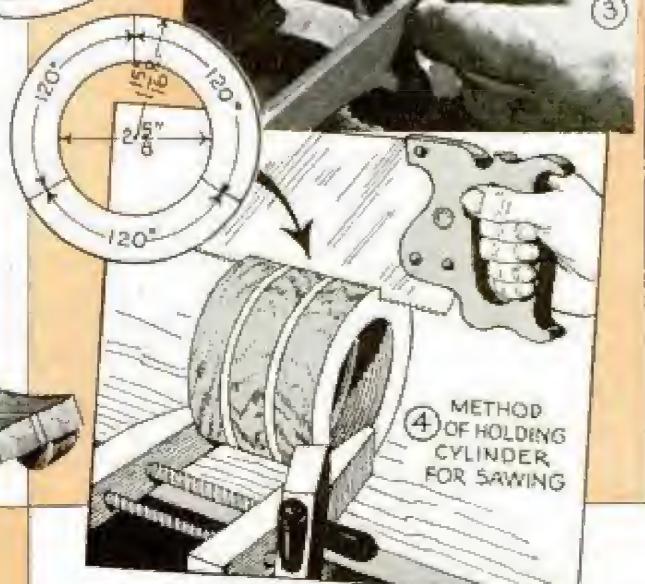
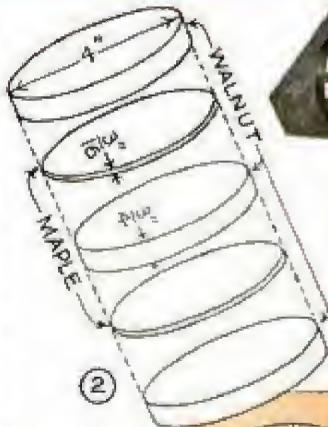
The CRAFTSMAN

Laminated DESK SET has roll-top trays



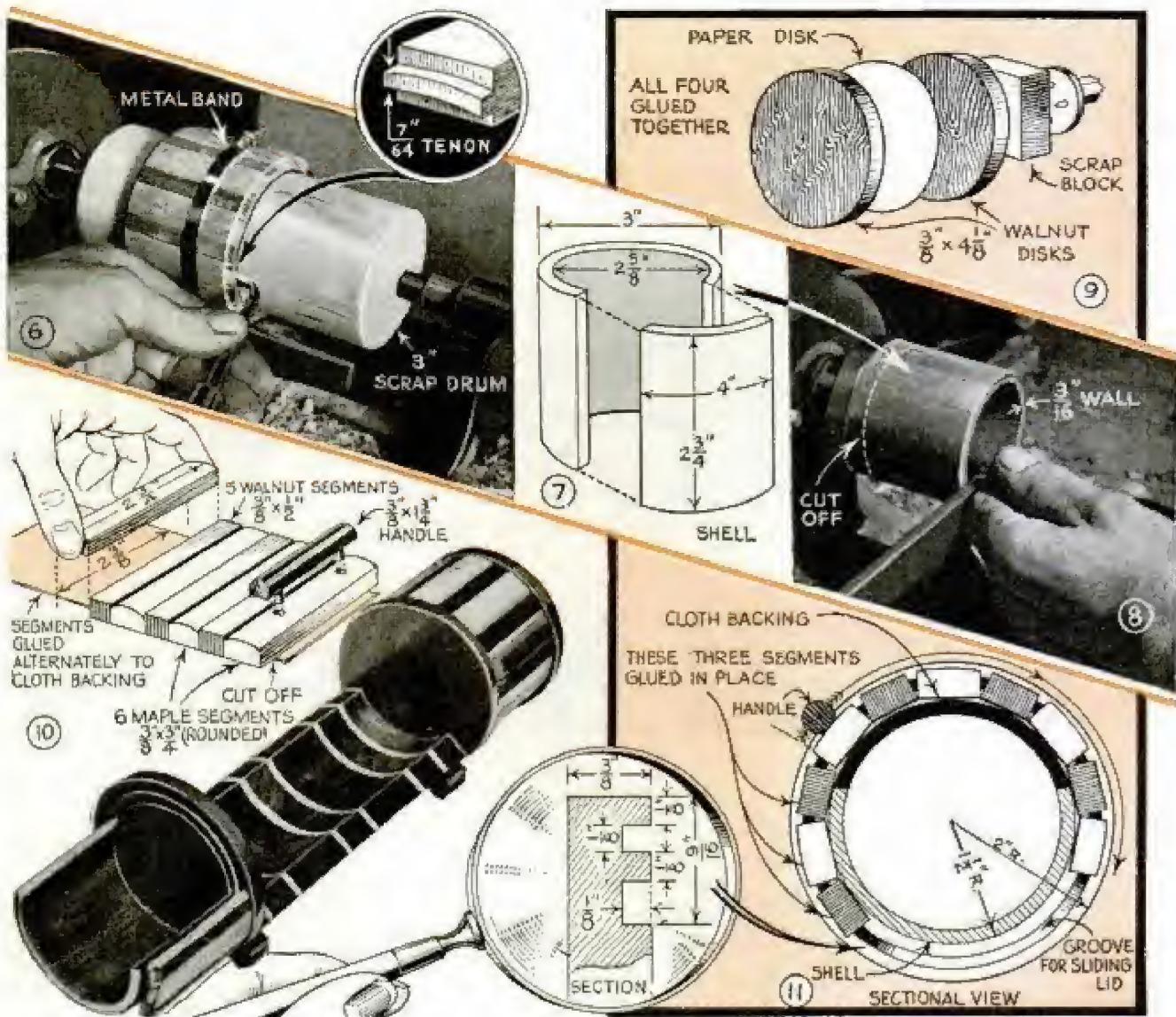
RICH, pleasing contrast of walnut and maple, carefully rubbed to a satin finish, makes this set, Fig. 1, a worthy piece on any desk. Begin with the pencil tray, which is made from walnut and maple disks arranged as in Fig. 2, glued together and then turned inside to form a cylinder as in Fig. 3. The cylinder is divided and cut into three equal sections as in Fig. 4. Next, the sections are assembled end to end with dowels and glue as in Fig. 5, and fitted at each end with two turned feet.

Now you are ready for the roll-top trays. For the ends of these, you need four walnut disks. These are glued in pairs to a small block with a paper disk between them as in Fig. 9, and are turned to size on the faceplate. Then the grooves to receive



(5) HOW THE THREE SECTIONS ARE ASSEMBLED TO FORM TRAY

This elegant, modern-styled desk set for your pens, with roll-top trays for clips, pins, etc., is made of walnut and maple or birch, which give an attractive two-tone effect



the cylindrical body and roll top are cut in the face of one disk and the back of the other. See the magnified detail of Fig. 11. Next, the disks and block are separated at the paper-and-glue joints and sanded. This procedure permits the grooves to be cut without mounting each disk individually. Repeat this work on the other two disks and attach two of them to the ends of the trough with dowels and glue. Make the two cylindrical bodies as in Figs. 7 and 8, and you are ready for the roll tops. These are made up by gluing walnut and maple segments to a cloth backing as in Fig. 10. Notice in Fig. 11 that three of the segments are not glued to the cloth, but are glued directly in the grooves of the end disks and serve as stops for the tops. After the segments have been glued to the cloth, the assembly is clamped to a drum mounted between lathe centers as in Fig. 6. Tenons are turned on the ends of the segments to slide in the grooves of the end pieces. As the fabric-and-segment assembly does not form a complete cylinder, it will be

necessary to fill in between its ends with scrap pieces so that a metal-band clamp can be used. After assembling the trays, finish the set with two coats of shellac which can be rubbed down to remove the luster if desired.

Space-Saving Chisel Holder

An efficient chisel holder can be made quickly by lacing together three pieces of leather cut to size desired. The lace forms the compartments, and the center piece should be $\frac{1}{2}$ in. higher than the side pieces. The leather can be oiled to protect the chisels against rust.



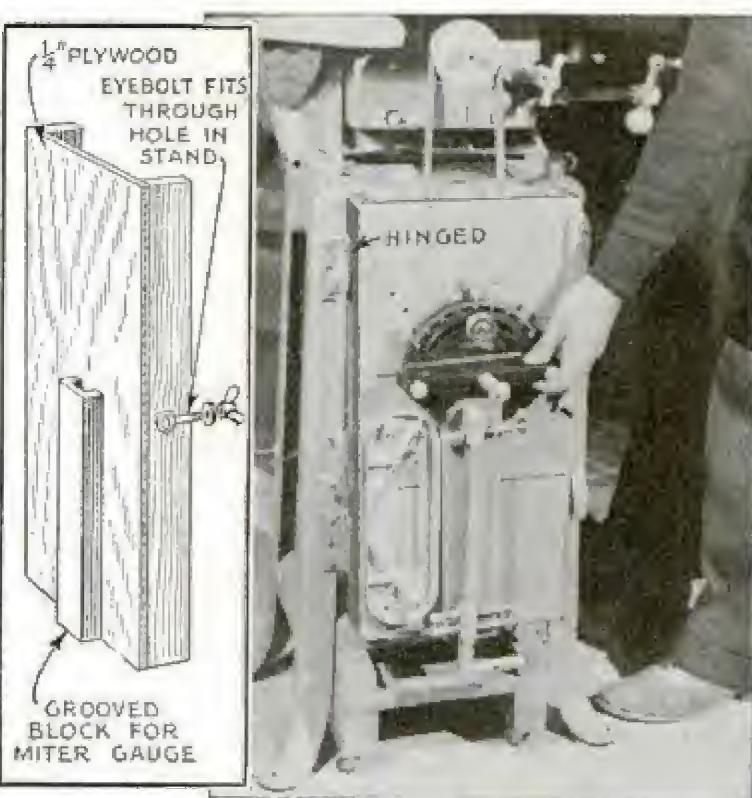
Belt Guard on Circular Saw Holds Accessories

A belt guard that holds several accessories is a useful addition to a home-shop circular saw of the type that has the motor pulley and belt overhanging the table. The guard is made of wood and is hinged to one leg of the table. An eye bolt screwed to the guard fits through a hole in the other leg and makes the belt and pulley accessible for inspection. On the outside surface of the guard are mounted the most used accessories.

Waxing Ski Runners

I have found a chemical heat pad effective in warming ski runners before waxing them. When the wax is put on the warm runners it will flow freely and can be rubbed on in a few seconds.

—F. D. Slayton, Wilmette, Ill.



Perforated Paper Pattern Made on Your Sewing Machine



If a design is to be used numerous times on different articles, the easiest way to transfer it is with a perforated pattern. To make such a pattern, stitch the outline on a sewing machine, from which the thread has been removed. First draw it on firm, non-absorbent paper. Heavy vellum tracing paper is best and can be purchased by the yard at art stores. The space between the perforations can be regulated by adjusting the length of the stitches. Charcoal, lampblack, talcum powder, paste made by melting wax crayons or ready-prepared stamping wax can be used to transfer the design onto the material. This is applied easily with a felt or cotton pad. The pastes require a small amount of naphtha or benzine to moisten them sufficiently.

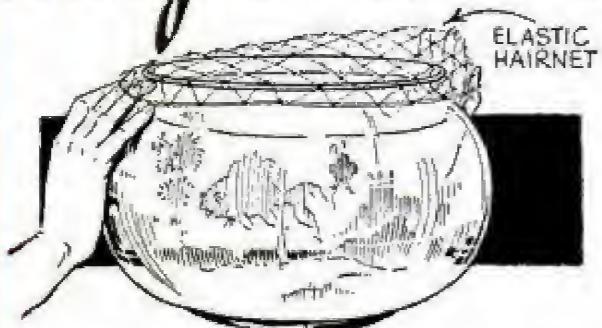
Pencil with Weighted End Will Not Break When Dropped on Floor

The point of a lead pencil is not likely to break when dropped, if the opposite end of the pencil is weighted so that it will reach the floor first. A simple weight that does not interfere with use of the pencil consists of a piece of wire solder wrapped around the pencil and crimped in place.

¶A mattress turned regularly will keep in good condition twice as long.



Solving HOME



If you have had fish jump out of a bowl at night, a hairnet will solve the problem. Get one of the type that has an elastic band around the outer edge and slip it over the top of the bowl. It's easy to remove or put in place, allows plenty of ventilation and presents a neat appearance on the bowl

A piece of rubber shaped as above and fastened to the food chopper with a band is a safety precaution when feeding pieces of meat into the chopper with the hand. The rubber stands vertically out of the way when not in use



Your laundered sweater need not be marred with clothespins or stretched out of shape when drying if you suspend it with a towel run through each sleeve and attached to the line with clothespins at the neck and cuffs as above

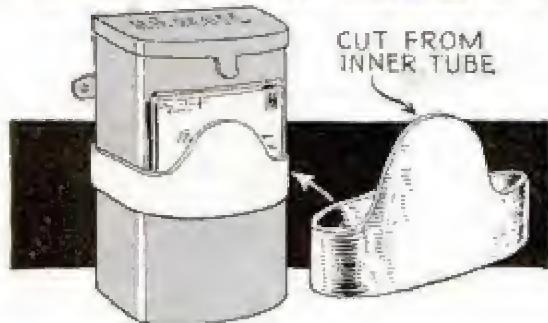


Slipped over a chair leg or rung, the holder above will keep a ball of yarn off the floor while knitting. Holder is made of spring wire, and rubber over the coiled portion protects the chair finish as indicated



The tray at the left is just the thing for serving tea while you chat on a davenport. By soldering the bowl of a spoon to a case knife as above, you can dip semi-solids such as sauces and salad dressings, and spread them on the bread slices in one operation when making sandwiches

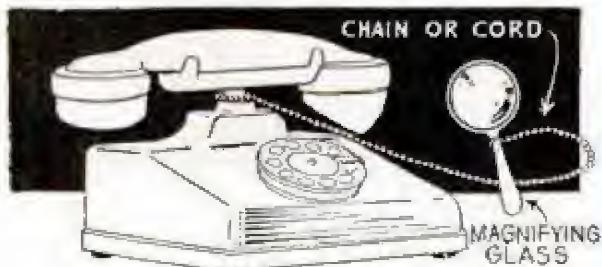
PROBLEMS



Letters to be picked up by the postman will be visible readily yet protected from being blown away if a rubber sleeve is stretched over the outside of the mailbox under which they may be inserted. A piece of old inner tube is used for this, cutting it to the shape shown above to provide a flap to take the letters.

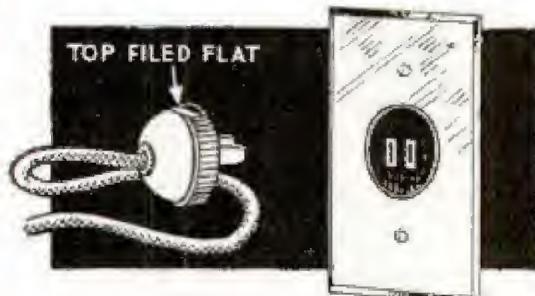


Staple a length of ordinary chicken wire across the studding of your garage and you'll have a good hanger from which your garden rake cannot be jarred accidentally. The teeth engaging the mesh make it difficult to dislodge the rake, yet allow it to be hung up or removed quickly.

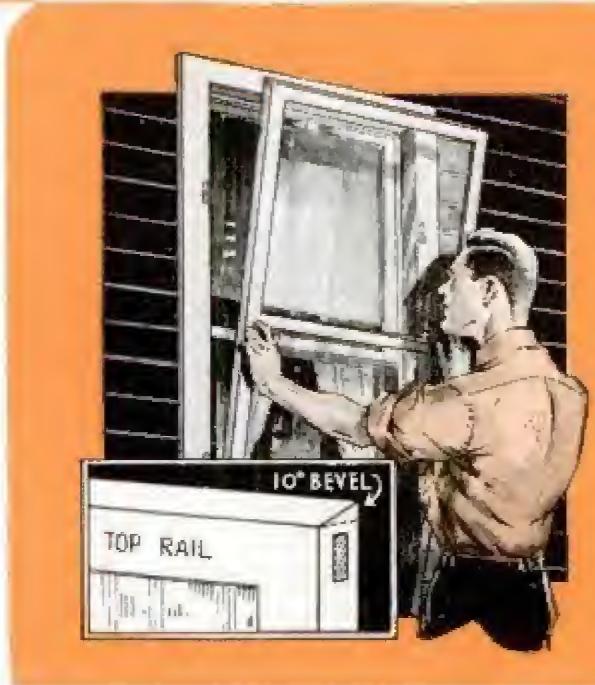


Persons who find it difficult to see the numerals on dial-type telephones will appreciate the use of a small reading glass when it is attached conveniently to the phone with a chain or cord as above. A bevel planed across the top of your storm windows as at the right, will prevent swelling and rotting of the wood by allowing water to drain off the sash.

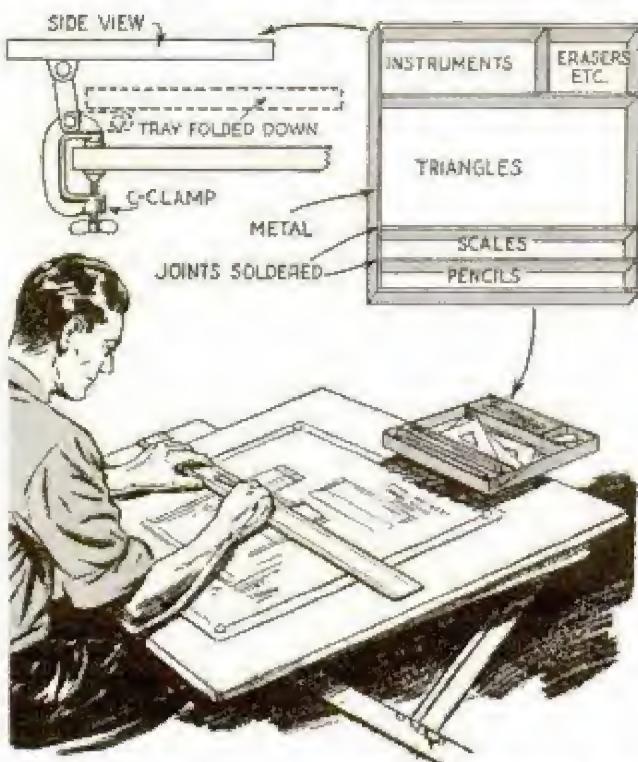
The back of a closet door, when fitted with a narrow shelf across the bottom, makes a convenient out-of-the-way place to store a small stepladder. A strap with the ends nailed to the door near the top of the ladder is used to hold it in place when opening and closing the door.



File a flat spot on the top of an electric plug so that you can feel with your thumb when the prongs are in a vertical position. This helps inserting the plug into a wall outlet located in a dimly lighted place where it is hard to see.



Tray on Artist's Drawing Board Keeps Accessories Handy



Your drawing instruments, erasers, triangles, etc., will always be together and close at hand if they are kept in a metal tray like the one shown. It is attached to the board with a C-clamp, which permits it to be removed quickly. Use of bolts and wing nuts to pivot the link between the tray and clamp permit the tray to be adjusted at any angle desired.

Paper Clip Holds Pen Points for Ruling Lines

When it is necessary to draw a number of parallel lines, several can be made at one time by holding the required number of steel pen points in a spring paper clip like the one shown. All the pens must be



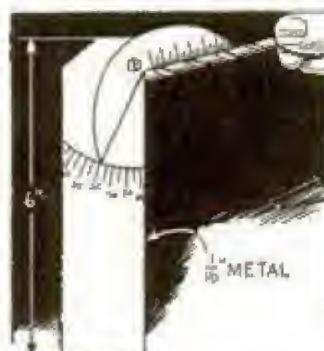
of the same size, although the type of points may vary if desired. The inner surfaces of the clip jaws should be lined with narrow strips of rubber, so that the pens will remain in position without sliding.

Enlarging Ice-Skate Screw to Grip It Easily

If the adjusting screws of your clamp-type skates are so small that they are difficult to turn while wearing gloves, wrap them with a few turns of friction tape. The larger diameter and the additional friction provided will make the job easy.



Adjustable Drill-Grinding Gauge



I often have to sharpen drills at various angles for use on special jobs in my work and find the adjustable gauge shown handy in quickly getting the correct angles. A bevel protractor was used in laying off the degree divisions, and the angle finder is pivoted with a machine screw, the head of which is countersunk.

—Versel Behlke, West Allis, Wis.

Simple Model-Train Hitch

In building a model train the difficulty in getting a hitch that is rigid, yet allows sufficient freedom for the cars to move around on a curved track, is solved by using ordinary snap fasteners such as used on garments. Both sections of a fastener are attached as shown.

—Everett Hanson, Argyle, Wis.



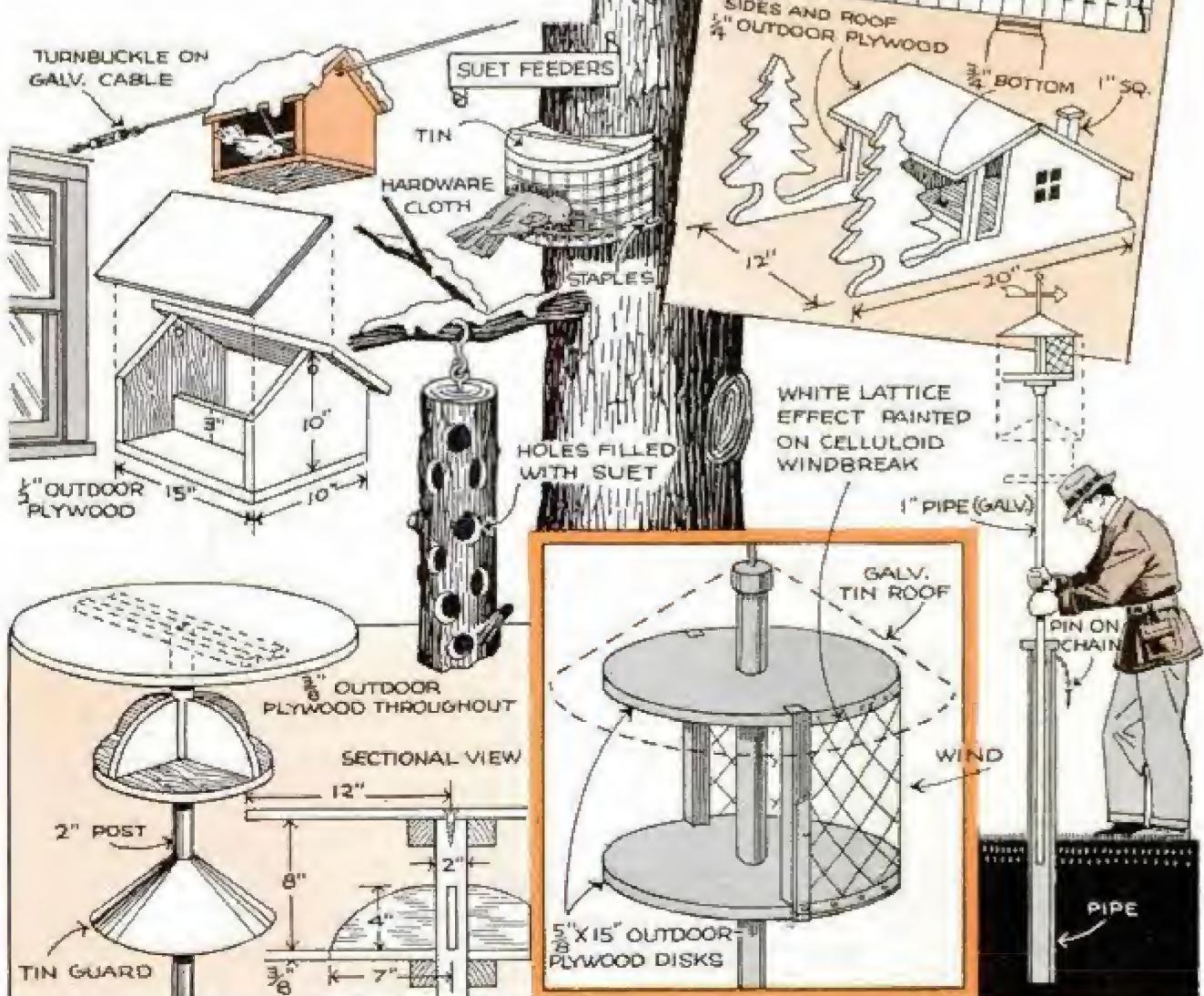
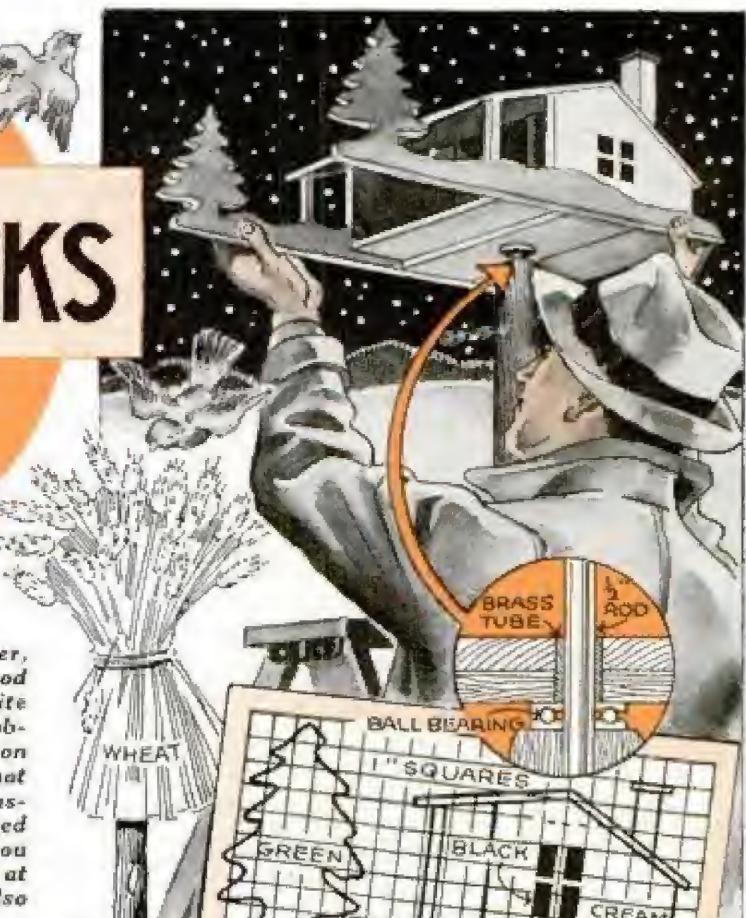
Never brush suede shoes while they are damp. Dry them, then use a wire brush.

Winter

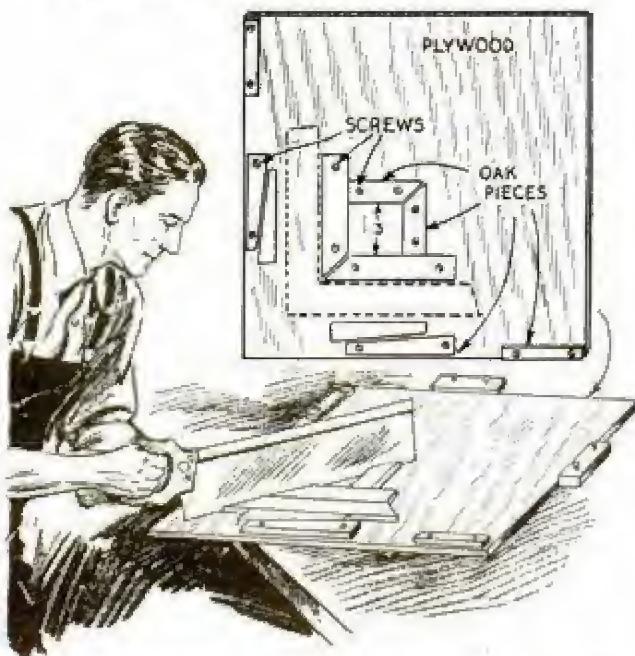
SNACK SHACKS

for Birds

By providing feeding shelters for birds in winter, when snow and sleet seal up their natural food supply, they will reward you by becoming quite tame and interesting subjects for study and observation. The shelter at the right is pivoted on a post and swings around in the breeze so that food will not blow away. A sliding feeder suspended from a line as shown below can be moved a little closer to the house each day so that you can observe the habits and antics of the birds at close range. A sheaf of grain on a pole is also welcome to snowbound birds



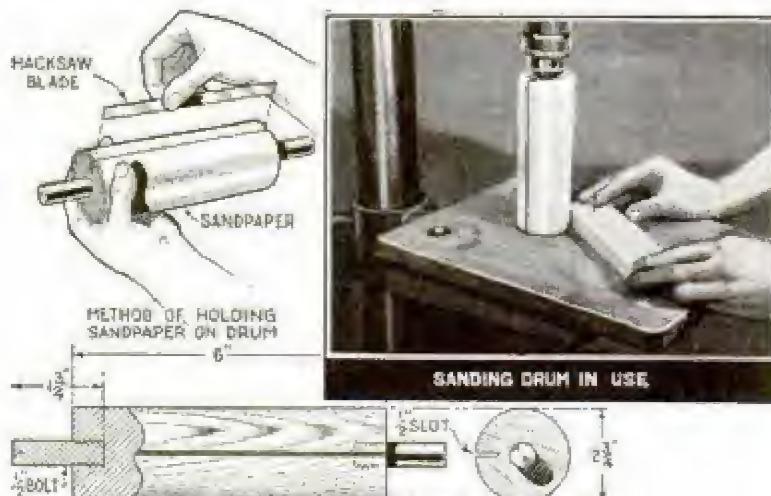
Picture Frame Cut and Assembled Quickly in This Miter Board



Picture and similar frames can be cut accurately and assembled right in this miter board. The stock to be mitered is held by wedges as indicated. After the miter has been cut, glue can be applied and the joint nailed while the assembly is held by the board.—L. B. Robbins, Harwich, Mass.

Reversible Drill-Press Sander Has Two Grades of Paper

Different abrasive surfaces are made available with this sanding drum by merely changing ends in the drill-press chuck. The drum is turned from hardwood, and the projecting spindles or shafts are headless bolts having the threaded ends turned into tight-fitting holes in the drum. The abrasive paper is wedged in the drum slot with a hack-saw blade. This was found better than a wood wedge as the teeth

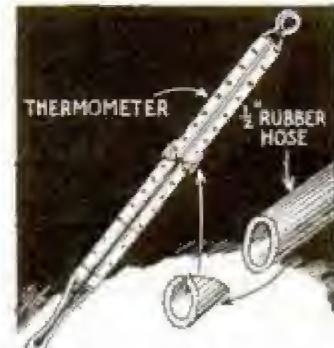


tended to bite into the paper and force it tightly into the groove. In use, different grades of paper are put on at each end of the drum.

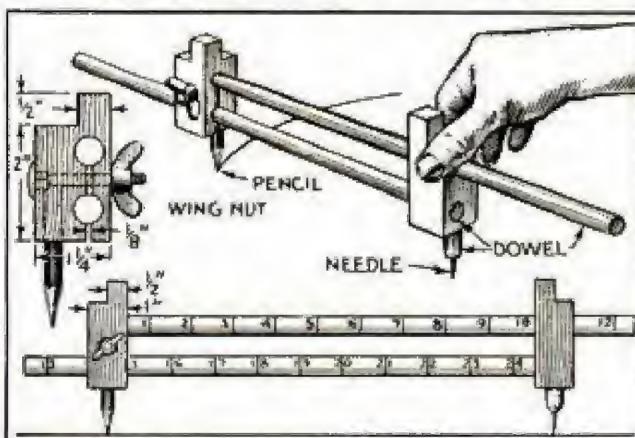
—Aremen Tashjian, Springfield, Mass.

Reading of Dairy Thermometer Marked by Rubber Hose Clip

Desiring to register the reading of his dairy thermometer for easy consultation, a Wisconsin butter maker cut a section from a small rubber hose and slipped this around the thermometer. The hose is small enough to grip the thermometer firmly against accidental dislocation, but may be slid up or down to a different reading in an instant.



Inexpensive Beam Compass

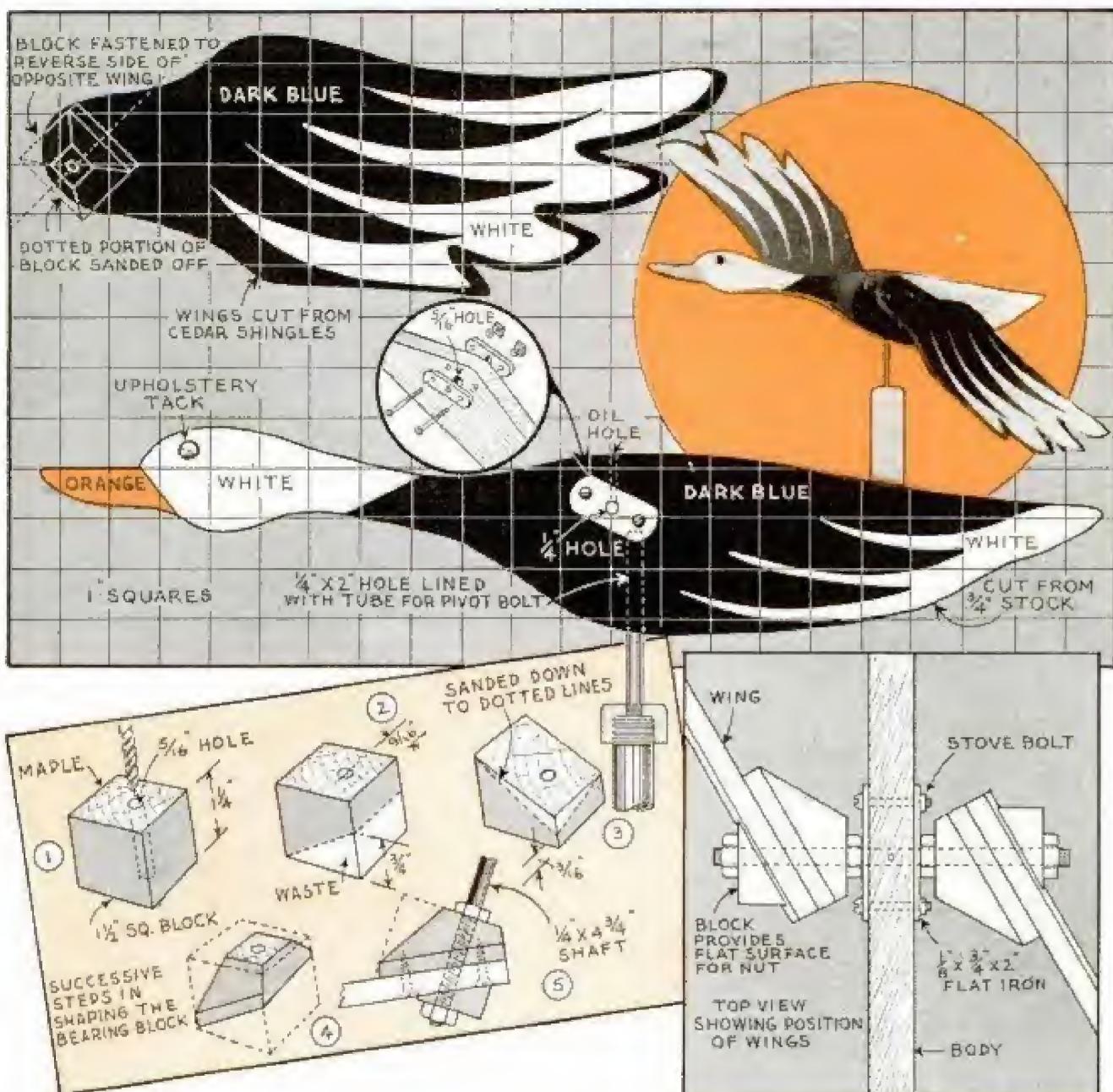


A practical beam compass that can be used also as inside or outside calipers can be made easily by anyone. Dowels are used for the beams and wood blocks in which the dowels slide carry the compass point and pencil. Opposite ends of the dowels are anchored firmly in the blocks while the other ends slide freely to permit adjustment. One block is slotted as shown and a bolt and wing nut are provided to lock the adjustment.

—Al Belanger, Chicago.

Storing leftover food scraps in a refrigerator is a waste of space and often spoils other foods.

Wooden Duck in Garden "Flies" Realistically



You'll have to look twice to see that this is not a real duck in flight. Colorfully painted and mounted atop the garage or trellis, it provides an amusing touch to any back yard. The body is sawed from cypress or cedar stock, while the wings are cut

from shingles. Bearings for the wing shaft are small metal plates bolted to the sides of the body. The wings, which are held at the proper angle with blocks shaped as shown, are fastened to the shaft with nuts drawn up against small shouldered blocks.

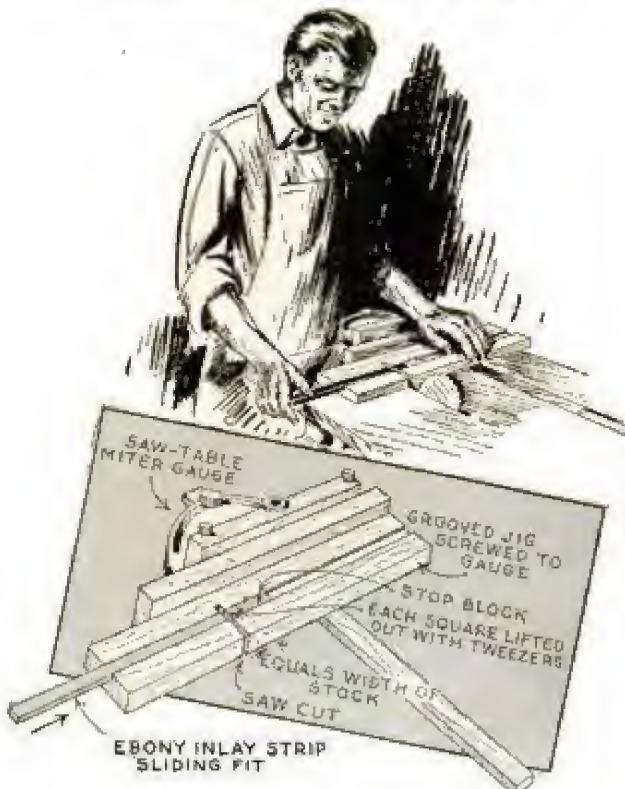
Neat Case for Your Ship Model Is Assembled from Wood and Celluloid



Made of wood and sheet celluloid, this case will protect small models against dust. If care is taken in finishing the wood and attaching the celluloid, the case will have a very neat appearance.

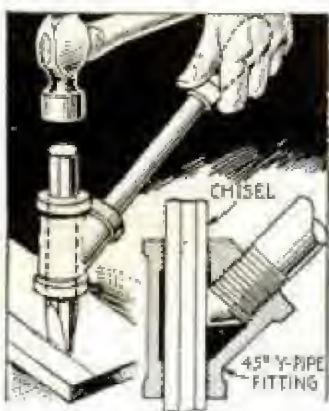
If you coat the inside of a catsup-bottle cover with paraffin it will prevent objectionable discoloration.

Tiny Pieces of Inlay Cut Safely with This Grooved Jig



Having several strips of ebony to be cut into tiny pieces $\frac{3}{8}$ in. square for inlays, I solved the problem of holding such tiny pieces and also preventing chipping of the work as shown. A pine block was grooved lengthwise to take the strips with a snug, sliding fit. The block was then screwed to an upright piece, which in turn was attached to the saw miter gauge. A small stop block, to permit the strip to be moved an equal distance after each cut, was fitted in the groove at the proper point from the entering saw cut. By using a fine blade, I was able to produce perfectly cut pieces quickly.—Wayne C. Leckey, Aurora, Ill.

Chisel Kept in Holder by Handle



The safety of having a holder when working with a chisel is more than worth the time to make this one. A twist of the handle loosens the chisel for removal. The body of the holder is a Y-pipe fitting, and the handle is a length of rod threaded to screw into one side of the fitting. The end

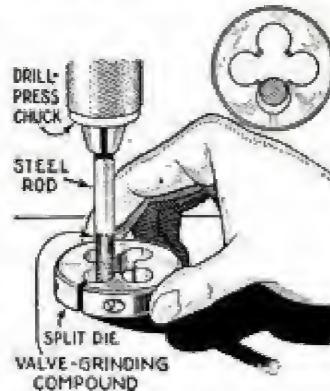
of the handle is beveled to provide a good bearing surface against the chisel.

—Chas. H. Willey, Penacook, N. H.

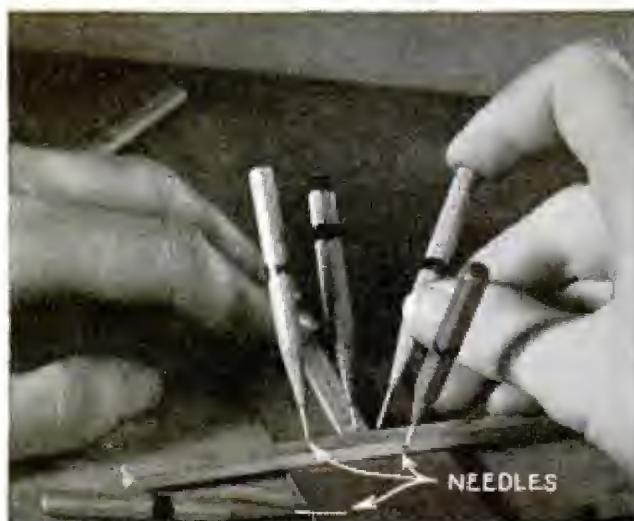
Dies Sharpened on a Drill Press

I have found the simple method illustrated very effective in sharpening small dies. To do this, a steel rod slightly smaller in diameter than the holes in the die is chucked in a drill press, which is then turned on, valve grinding compound being applied to the rod. I take each hole separately, first on the starting-thread side of the die and then on the finishing-thread side, applying a little more compound as I proceed.

—Henry Wyma, Jr., Chicago.



Needle Pegs Help in Gluing Small Pieces Together



Modelmakers and others who work with pieces of wood so small that it is difficult to use clamps on them when nailing or gluing the parts together, will find these little needle pegs helpful. They consist of $\frac{1}{16}$ -in. strips of maple with headless needles inserted into the tapered ends. The pegs are used by pushing the needles through the part to be clamped into the part to which it is to be fastened.

—M. J. Stair, Chicago.

▲A clothespin split in two provides small wedges for silencing rattling windows.

Fall Care of Your FLOWER BULBS

By
ROBERT STAHLER

DO YOU inadvertently abandon your flower bulbs after they have bloomed? Then, it is no wonder that they do so poorly the following season. Proper treatment of bulbs, corms and tubers will cut to a minimum the annual losses, and will produce better flowers.

Bulbs may be divided into two classes, namely: the hardy types Fig. 1, those that flower in the spring, and the tender species Fig. 4, that bloom later in the season. The term "bulb" is a rather broad one. Hyacinths, lilies, tulips, etc., are true bulbs, but the term is also applied to the corms of gladioli (glads), the tubers of dahlias, and the thick fleshy root stocks or rhizomes of iris. All of these have in common several cultural requirements. They require a fairly rich soil, well drained and not too heavy. It should be spaded deeply, especially for bulbs that must be

TIMELY HINTS ON PREPARING SOIL, PLANTING AND WINTER MULCHING



1 PLANTING CHART FOR HARDY BULBS

	SET 2 OR 3" APART - COVER WITH 2" SOIL		SET 3" APART - COVER WITH 2" SOIL
	SET 7 TO 8" APART - COVER WITH 4" SOIL		SET 5" TO 8" APART - COVER WITH 4 TO 5" SOIL
	SET 3" APART - COVER WITH 3" SOIL		SET 6 TO 12" APART - COVER WITH 4" SOIL

Lilies

2

Base-rooting species:

- Nankeen Lily (*Testaceum*) plant 5 in. deep
- Madonna Lily (*Candidum*) 4 to 5 in.
- Sierra Lily (*Parvum*) 4 in.
- Star Lily (*Concolor*) 4 in.

Stem and base-rooting species:

- Coral Lily (*Tenuifolium*) 5 in.
- Turk's-Cap Lily (*Martagon*) 5 in.
- Elegans (*Thunbergianum*) 6 in.
- Tiger Lily (*Tigrinum*) 9 in.
- Goldband Japan Lily (*Auratum*) 9 to 12 in.
- Regal Lily (*L. Regale*) 12 in.

set well below the ground. If manure is used, it should be decayed thoroughly and worked well into the soil several months prior to planting time. Instead of manure, the soil can be enriched by working in peat or leaf mold and then adding finely ground bone meal in the proportions of about 15 lbs. per one hundred square feet, reducing this to 10 lbs. each year thereafter. You'll find this non-burning, high in phosphorus and it contains about two or three per cent





④ PLANTING CHART FOR TENDER BULBS

	
SET 6" APART-COVER WITH 4" SOIL	SET 12" APART-COVER WITH 2" SOIL
	
Begonia	Canna
	
SET 18" APART-COVER WITH 2" SOIL	SET 36" APART-COVER WITH 6" SOIL
Caladium	Dahlia

of nitrogen. Supplement the bone meal with a mixture consisting of sulphate of potash, 1 lb., and slowly dissipating organic-nitrogen fertilizer, a few lbs. It has been found that fertilizer is best worked in with the first spring cultivation.

To flower, bulbs require very little aid from nature, but the energy they have ob-

tained from sunlight and nutrition must be replaced. The action of sun and light on the chlorophyl content of the leaves has much to do in replacing this stored energy. While it is frequently done, the leaves should not be cut away after flowering. Let them wither and fall off by themselves. Meanwhile, provide plant food as directed, water when necessary, and make shallow cultivations. Seed formations add a heavy drain to bulb energy. For this reason, faded blooms and seed pods should be removed at once.

When flowers are picked for use in the home, cut the stems sufficiently long enough for your purpose, yet short enough to allow the ripening bulb, corm or tuber to mature. Gladiolus spikes should be cut when the first bloom is fully opened, the remaining ones will continue to open in water and will last many days. Gladiolus corms, like all true corms, disappear each season, but the plants grow new ones. To ripen or mature this new crop, a generous fan of foliage must be left when cutting the blossoms.

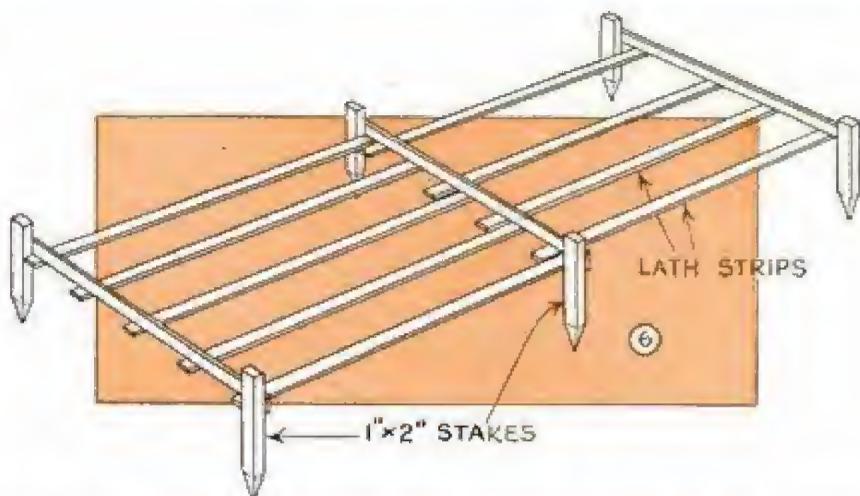
In the colder regions, hardy bulbs should be mulched. The purpose of this is to prevent injury to the bulbs by the alternate freezing and thawing action of the soil. Figs. 5 and 6 show a simple frame which can be supported above the bed, using common wood lath strips to hold your mulching in place. For this, straw, hay, leaves and excelsior may be used. It is best not to mulch the ground until the first freeze. Lilies require a rather thick mulch. Narcissus, hyacinths and tulips will do with less. In early spring lift the mulch and look for emerging growth. At its first appearance, clean off the beds, regardless of weather. With the exception of lilies, which should be covered with an old sheet, most bulb growth above the ground can survive late frosts.

The chart given in Fig. 2 lists a few of the more commonly grown varieties of lilies. Generally, lilies are set too deeply. Note that the planting depth given is measured from the top of the bulb and not from the base. If you live in a northern locality, mulch the prepared beds heavily with

leaves or straw to prevent hard freezing. Medium-size bulbs are preferable. They require a cool soil and welcome a mulch of peat when the growth is well above the ground and the days are continuously warm. Some varieties, especially those of the base-rooting species, may show no growth at all the first year. This is to be expected, so do not disturb them, for you may break off growing stems.

With the exception of tulips, very little is gained and invariably harm is done by frequently moving established hardy bulbs. If necessary to transplant, delay the work until the foliage has withered completely. Tulips, however, thrive better if they are dug up several weeks after the foliage disappears. The bulbs are spread out in a warm, airy location. Within a month they should be cleaned and reset. The second-year bulbs (the offsprings) will be smaller than the parent ones, but those an inch or more in diameter will flower the next season. September is the best planting month for hyacinths. Narcissus, which multiply rapidly, will eventually begin crowding. When this occurs let the bulbs remain in the ground a few weeks after the foliage has withered. Then lift the clumps, recondition the bed and replant at once. Use only the larger bulbs that fall away from the clumps. Original planting should be made in September, at which time the bulbs are usually shipped.

Gladioli do well in a fairly rich average soil free from manure. Plant them in rows 16 in. apart when the danger of frost is past. Successive weekly plantings up to July will provide continuous blooms until frost. Thrips make heavy inroads on gladioli unless sprayed every ten days with a solution of paris green, 1 tablespoonful, brown sugar, 2 lbs., and water, 3 gals. For further control, after the corms have been cleaned, in preparation for winter storage, shake naphthalene flakes, about an ounce,



in a paper bag containing about 100 corms. Dahlias require a soil similar to that for gladioli. When planting tall varieties, provide the necessary support stake, set the tuber, cover with 2 in. of soil and fill the hole as the sprout grows. Avoid too early planting, for dahlias flower best shortly before frost. The soil requirements for calla lilies, tuberous-rooted begonias and caladiums should be well drained and contain plenty of moisture. Work in liberal quantities of peat and when the season becomes dry and warm, use it also as a mulch. Calla lilies, which bear large flowers throughout the entire summer, do well in full sun while caladiums and begonias prefer part shade.

A dry, cool cellar having a winter temperature of about 45° is an ideal location for storing tender bulbs. If your basement is too warm, a satisfactory storage space can be made by partitioning off the coolest corner with cardboard. Clumps of dahlias and canna may be stored with the dried soil adhering to them while others should be cleaned. More expensive bulbs such as callas and begonias should be wrapped separately in newspapers. Gladioli keep well when stored in open woven baskets.

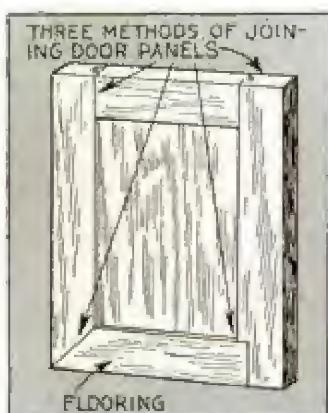
Fixture to Handle Angle Drilling Made from Old Piston



An old piston and part of a connecting rod assembled as indicated provide a handy fixture to hold work for angle drilling. The piston-and-connecting-rod assembly is welded to a steel plate, which is held on the drill-press table by bolts through the table slots. Clamps bent from flat steel hold the work to the piston top.

—F. Doughty, Yorkshire, Eng.

Panel Doors with Flooring Frames Are Easy to Make



should be glued and reinforced with nails, screws or dowels. Flooring comes in 2, 3,

and 4-in. widths so that it is easy to secure stock of proper dimensions.

—Maurice W. Patterson, Auburn, Wash.

Showcard Ink Bottles Sealed by Cork on Mousetrap

To keep his showcard ink bottles sealed and ready for instant use, without the usual insertion and removal of corks, a window trimmer employs ball corks, which are mounted on the jaws of small mousetraps. The traps are tacked to the wall over his worktable in such a position that the balls may be lifted to snap down over the mouths of the bottles, sealing them tightly.



Dog Kennel in Back-Door Steps

A wooden barrel placed in the concrete back-door steps provides a place for the family dog. Less concrete is required and two jobs are accomplished for the price of

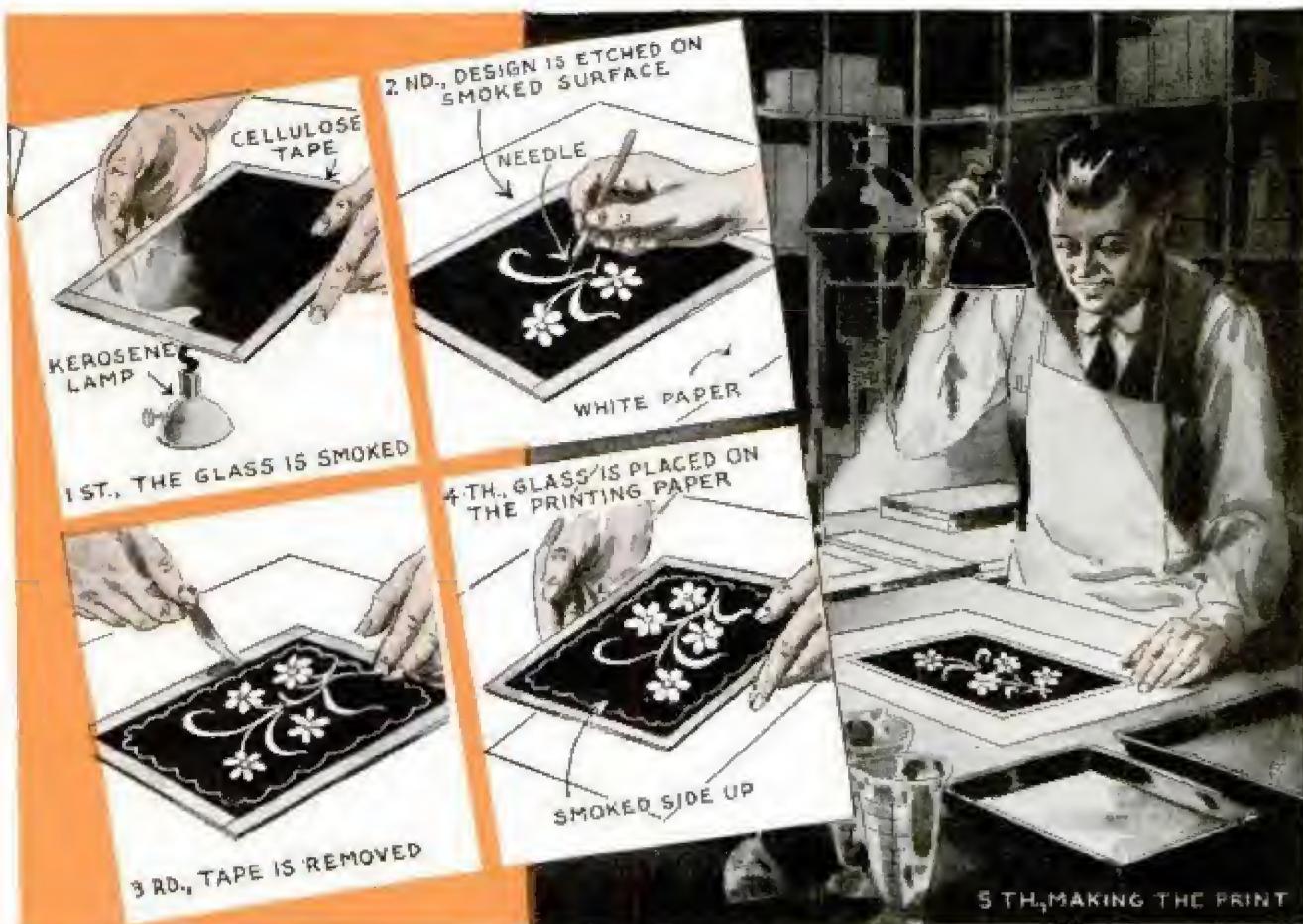


one, although a little more reinforcing of the steps will be necessary. If you do not have a dog, the extra space can be used to store rubbers, garden tools, etc.

—W. A. Junnila, Pullman, Wash.

If painted walls in your home are marred with a number of hairline cracks, stippling tends to make cracks and unsightly patches less noticeable.

Cards and Bookplates from Smoke Etchings



Personal cards, greeting cards, bookplates, etc., can be photo-printed from etchings scribed in smoked-glass plates, using the latter like a negative to reproduce any desired number of prints. Get a piece of clear, clean glass, bind the edges with tape for ease in handling and then move the glass over the flame of a candle or kerosene lamp until a thin layer of soot

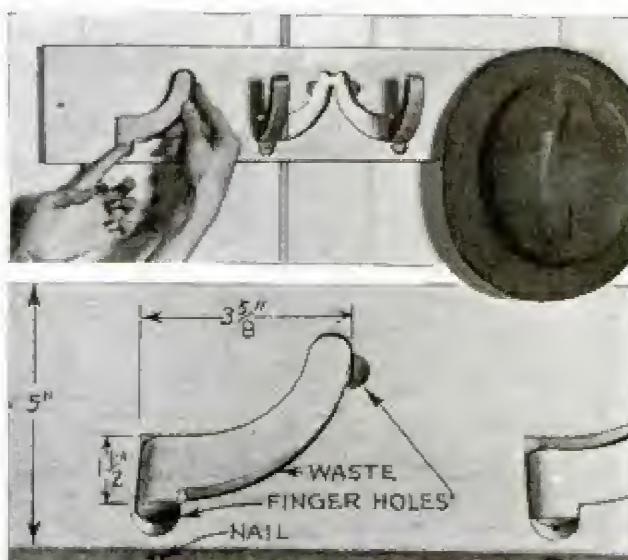
covers the surface uniformly. For scribing fine lines on this surface you use a needle, and for heavier lines, a more blunt-pointed instrument. Be sure to wipe the soot off the point of the scriber frequently as the soot piles up on the point and causes the lines to become wider. If a black border is desired, the tape binding is removed; if no border is wanted, the tape is left on.

Hat Rack Jigsawed from Wood Folds Flat Against Door

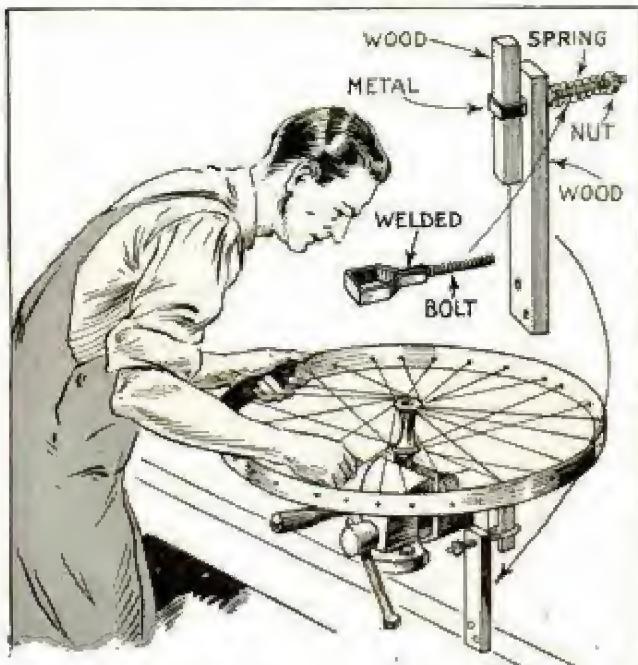
Here is a hat rack that is especially handy for mounting on doors that have plywood panels where regular hooks cannot be attached. Four hooks to fold toward the center of the rack are jigsawed from 1-in. pine. The hooks are hinged with nails. For ease in opening, small finger-holes are rounded out as indicated at the bottom and side of each hook.

—Benj. Nielsen, Aurora, Nebr.

Be sure water does not stand around your rose plants and freeze during the winter if you want them to live. Mound the dirt up well around the plants before the ground freezes.



Jig Aids in Truing Bicycle Wheel When Tools Are Limited



The cyclist or owner of a small shop who wants to true or stripe a bicycle wheel occasionally, but does not have the equipment, will find this little jig the solution to his problem. In use, the wheel is clamped in a bench vise by means of the spindle, and the jig is attached to the edge of the bench under the rim of the wheel. In it can be held a small hardwood block for truing the wheel, or a brush for striping it.

Wood Stain Made from Lacquer

Lacquer of either the brushing or spraying type provides a good wood stain when diluted with lacquer thinner. Use thinner, 8 parts, to lacquer, 1 part, and apply it with a brush, wiping off the excess with a cloth. If a spray gun is available, the stain can be applied evenly and the wiping omitted. Streaks and lines caused by overlapping



areas in the application can be removed by swabbing the wood with a cloth moistened with the thinner.

Shields for High-Top Shoes Protect Your Socks

Hunters and others who wear high-top shoes while walking through briars or tall weeds will find these shields handy. They cover the tops of the socks projecting from the shoes and prevent briars from catching in them. They are made by cutting sections from an old inner tube of suitable size.



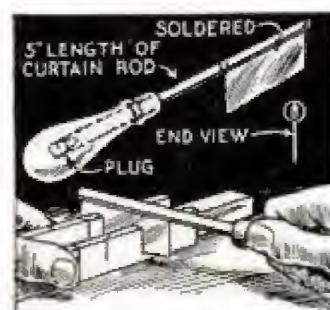
Rotating Lathe Center Has Ball Thrust Bearing



There are many times when a rotating center for the lathe tailstock is a necessity, yet many home craftsmen and small shop owners are without them because they feel that the occasional jobs do not warrant the purchase of one. However, a center like the one shown can be turned out easily by anyone. It consists of a steel shank turned to the proper taper to fit in a lathe tailstock and then drilled transversely to take the center. The latter bears against a thrust ball and is grooved to engage a set screw.

Tiny Panel Saw for Modelmakers

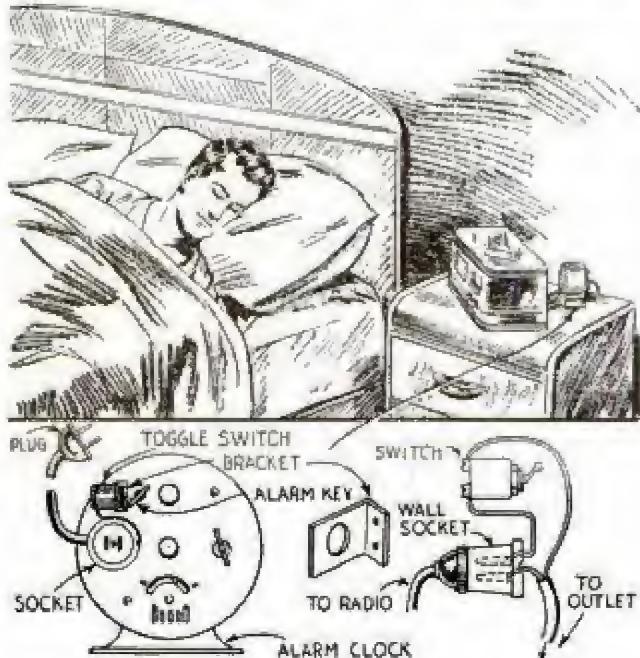
Modelmakers who experience difficulty in cutting small pieces of wood accurately enough for a close-fitting joint will find this saw an aid in doing the job. The blade is made from a single-edge safety-razor blade of the type having a metal stiffener. The beveled edge of the



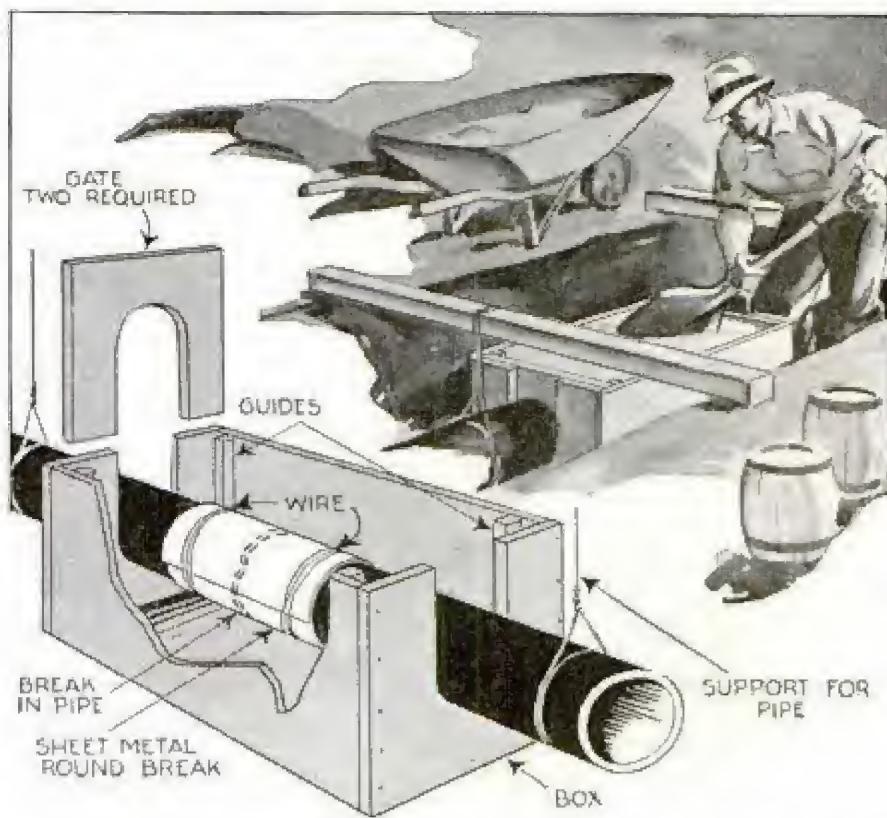
blade is ground off, after which teeth are filed in it. A handle for the saw can be made from a length of tubular curtain rod of the type having an open seam and a diameter of about $\frac{1}{4}$ in. Solder applied to both sides of the blade at the slot will hold it in place. Any wooden tool handle of suitable size slipped over the rod will do for a hand grip.—Grover G. Strother, Belington, W. Va.

Time Switch Turns on Radio or Other Appliances

A time switch to turn off or on a radio or other low-wattage electrical appliance can be assembled with an ordinary alarm clock and a small toggle switch. The latter is attached to the back of the clock by means of a bracket in a position that the alarm key will open or close the switch when the alarm goes on. Wiring of the switch is done as shown in the right-hand detail.—John L. Story, Washington, D. C.



Repairing Broken Pipe Lines by Pouring Concrete Around Them

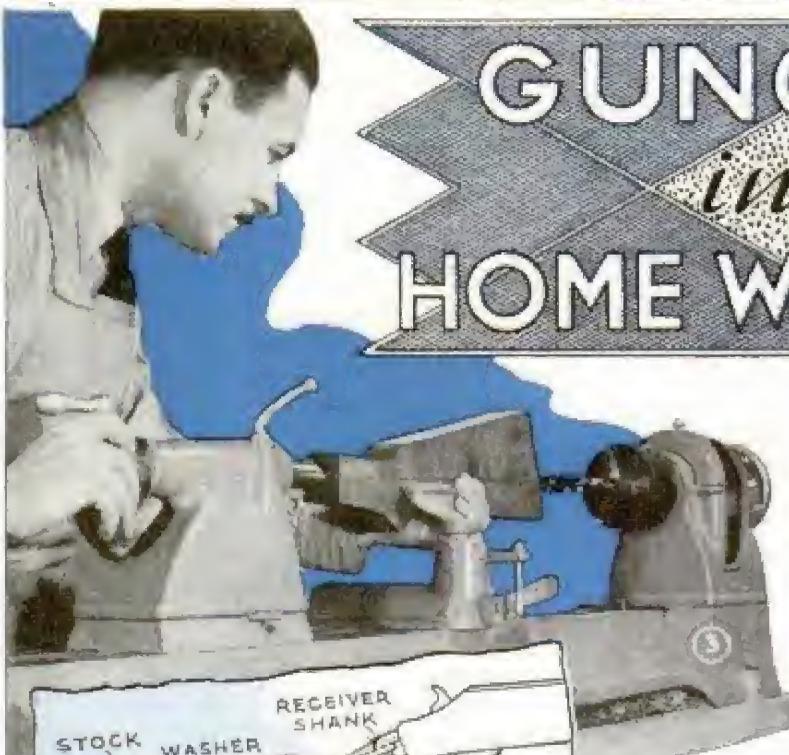
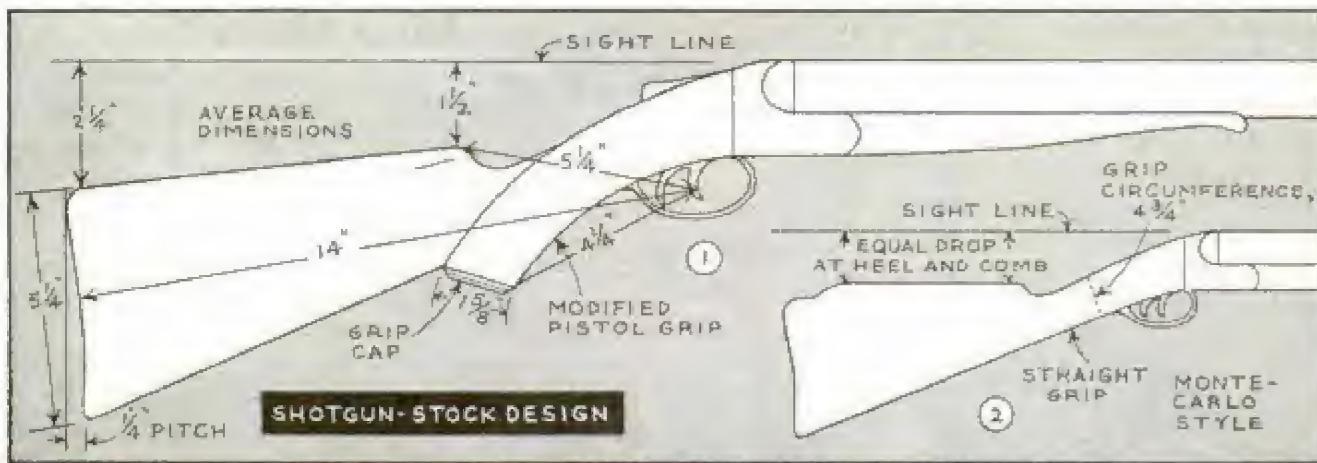


When a break or leak occurs in a pipe line, a repair often can be made as indicated. First line up the two broken sections and wrap them with sheet metal, which is then held in place with wire. A box is now fitted around the break and closed at each end with a gate. A cement mortar consisting of cement, 1 part, and clean sand, 3 parts, is poured into the box. This should be large enough to give at least a 2-in. thickness of mortar on all sides of the pipe, and more if the pipe carries high pressure. It is important that the pipe be well supported, either by props from below or by suspension from above. Small leaks are repaired similarly, except that support for the pipe usually is unnecessary.

Special Attachment for Pipe Vise

In small shops where a pipe vise is used only occasionally, it can be held in a bench vise if it is mounted on a piece of T-iron as indicated. This permits it to be stored away when not needed. If desired, two pieces of heavy angle iron placed back to back and welded together will provide a good substitute for the T-iron.

—Harold T. Quinn, Dolton, Ill.



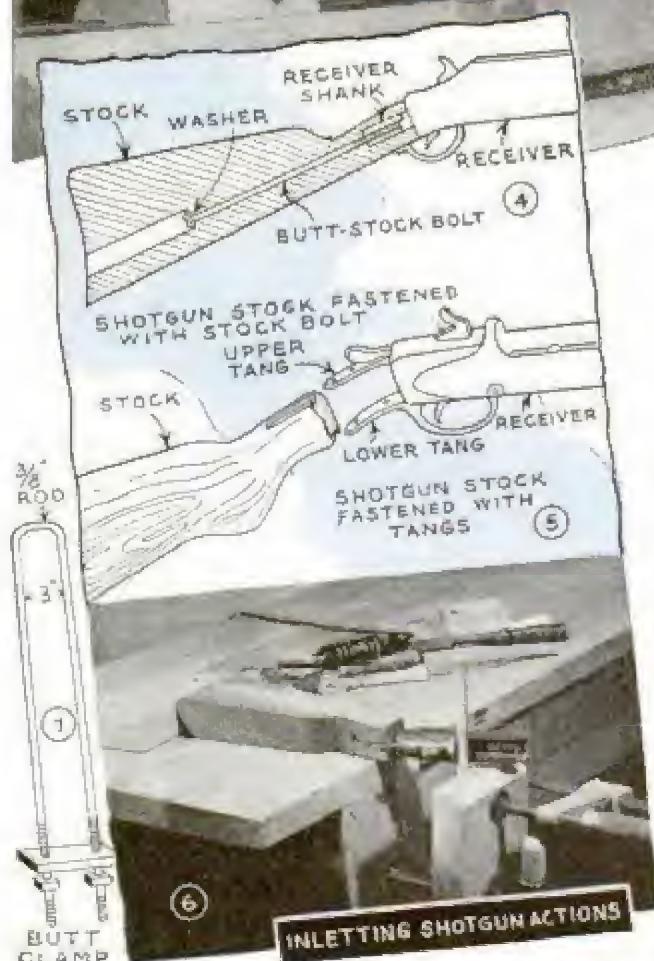
GUNCRAFT *in the* HOME WORKSHOP

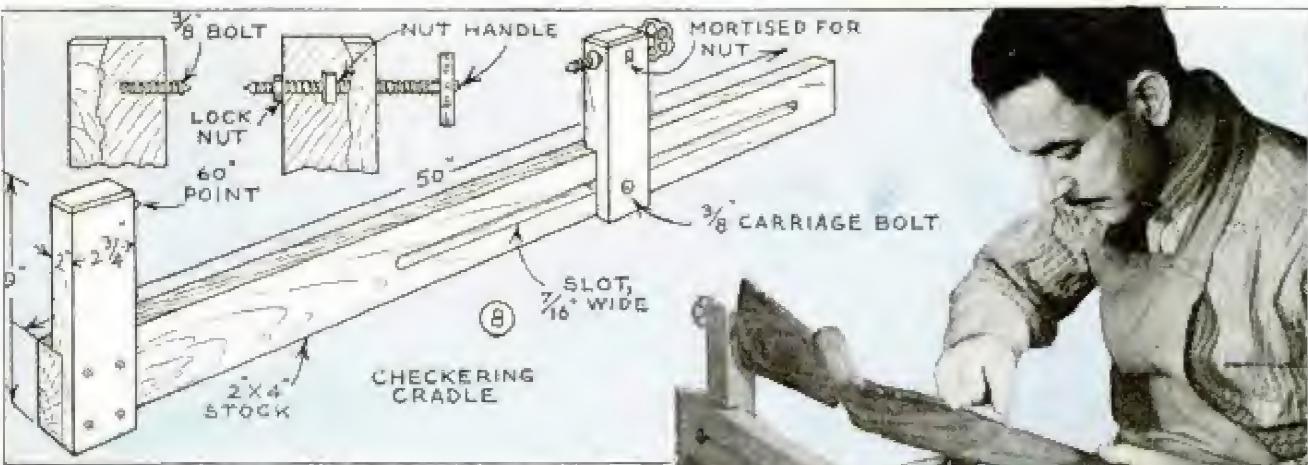
PART II

THE shotgun stock is usually longer and straighter than the rifle stock, which was covered in the first installment of this story last month. Figs. 1 and 2 give average dimensions, and show the two types of stocks that anyone can make.

Shotgun actions usually are easy to inlet. In one common style, the action is attached with a long screw through the stock, as in Fig. 4. This is a lathe job. With the stock blank roughly sawed to shape, run the large hole first, Fig. 3, then follow with the smaller hole. Fig. 5 shows an action that is held to the stock by means of tangs. As in rifle work, the parts are fitted exactly by coating them with lampblack and pressing in place. The portions of the wood that smudge from the lampblack are then "eased off." The "press" fitting necessary for this work can be done with a regular vise, Fig. 6. A butt clamp, Fig. 7, is the usual device used by the professional worker.

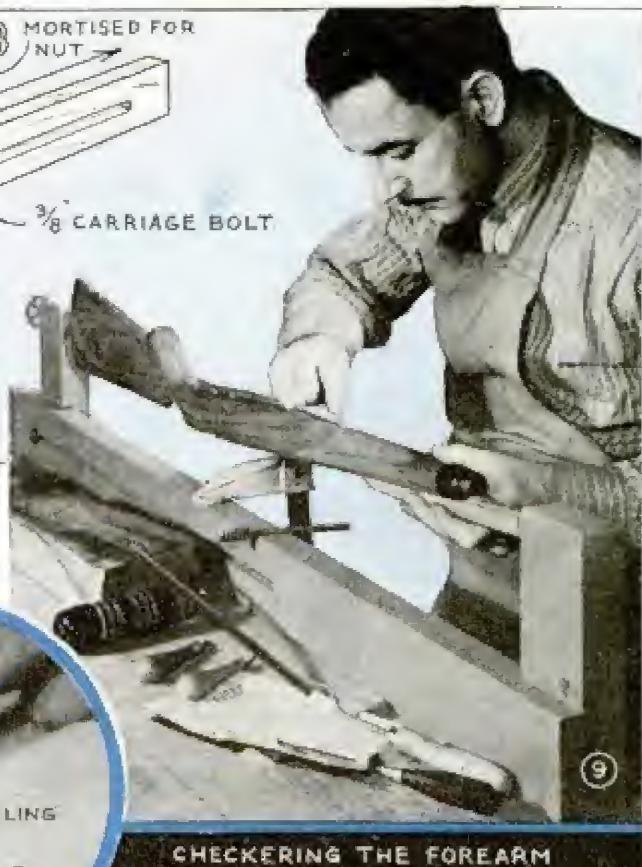
Checkering: Checkering adds to the appearance of any gunstock and at the same time provides a non-slip gripping surface. The lathe does excellently for holding the work, or a simple cradle can be used as in Figs. 8 and 9. Checkering tools can be purchased or made from tool steel, Figs. 10, 11



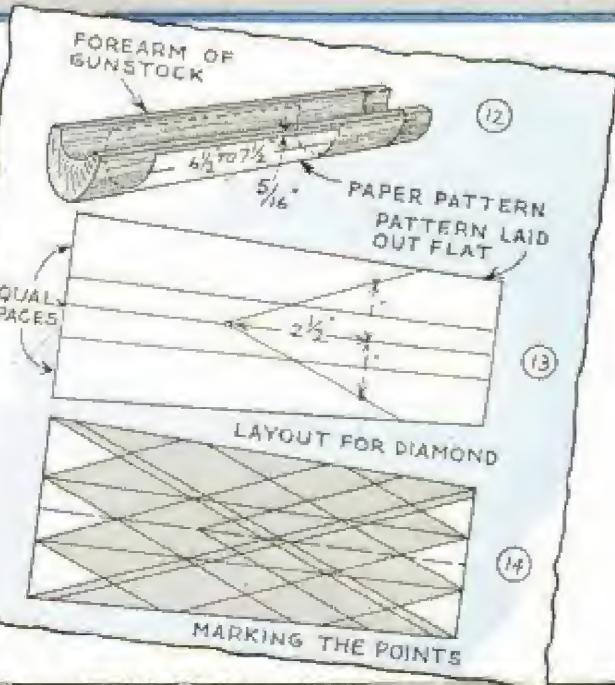
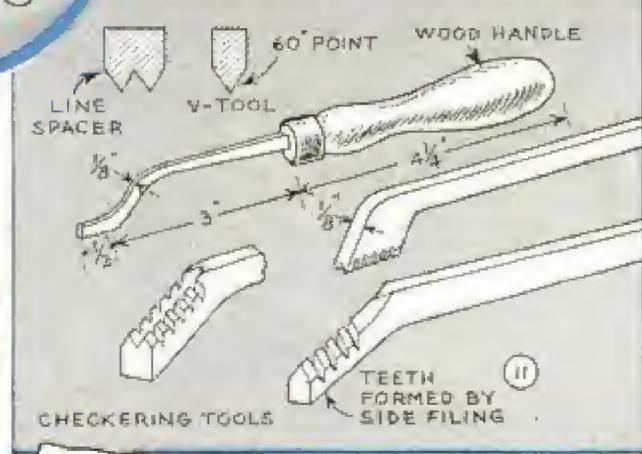


and 23. The line spacer is used to space the cuts, while the V-tool deepens them. The spacer should cut about 18 lines to the inch. The steel should be annealed so that the teeth can be filed by either of the methods given. A third tool is a three-corner file, which is used for deepening the cuts and general cleaning up.

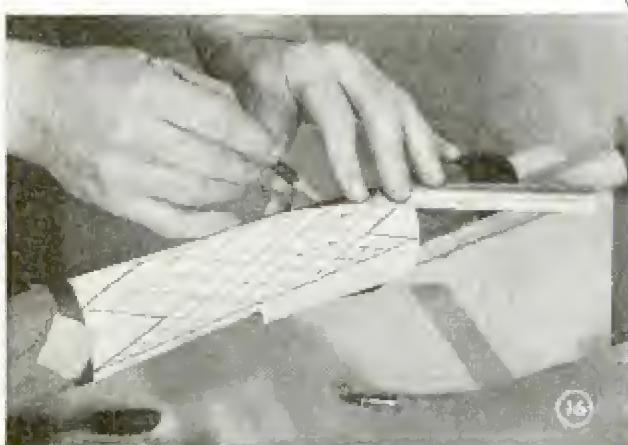
In checkering, locate the position of the design, which should be midway between the forearm tip and magazine tang, Fig. 15. Make a paper pattern to reach within $\frac{1}{16}$ in. of the top of the stock, Fig. 12. The pattern, when laid out flat, will be slightly wedge-shaped, as in Fig. 13. For example we will use the four-point design shown at A in Fig. 22, making the diamonds two and one-half times as long as the width. Using these proportions, lay out two guide lines from the centerline of the pattern, Fig. 13. All other lines in the design will parallel these lines. Fig. 14 shows the completed pattern. Run all the point lines right across the pattern,

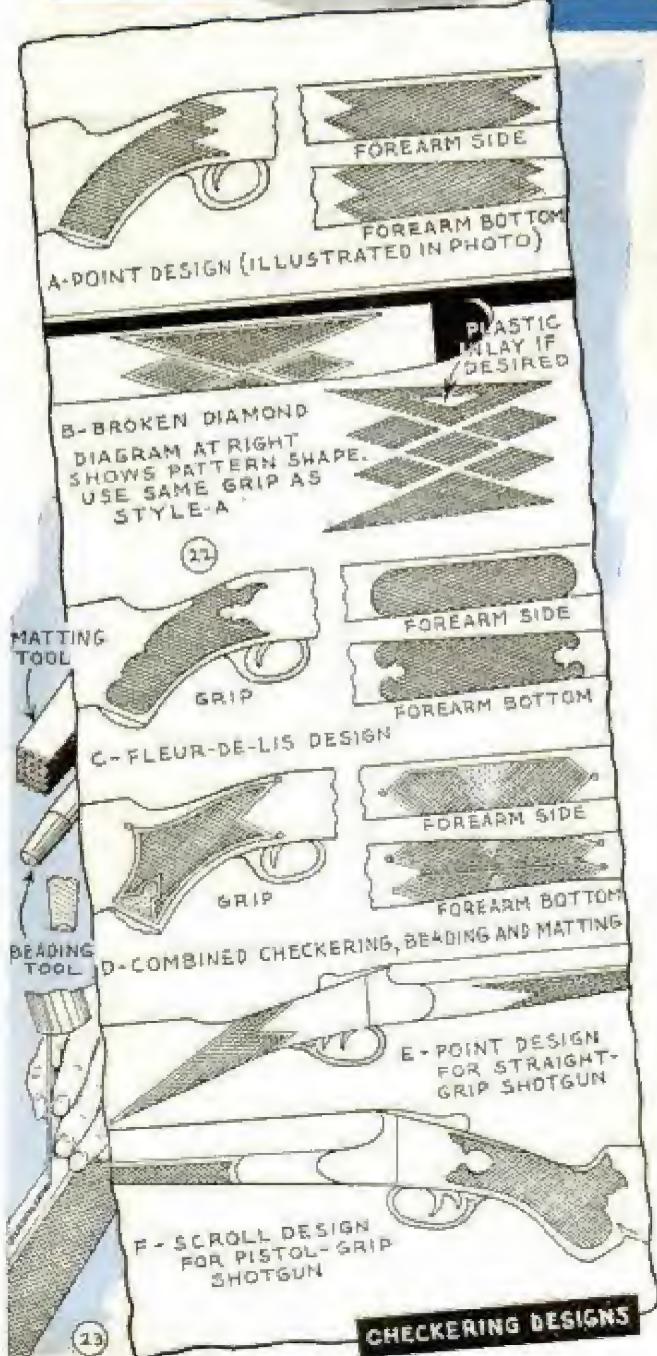


CHECKERING THE FOREARM



LAYING OUT AND MARKING FOREARM PATTERN



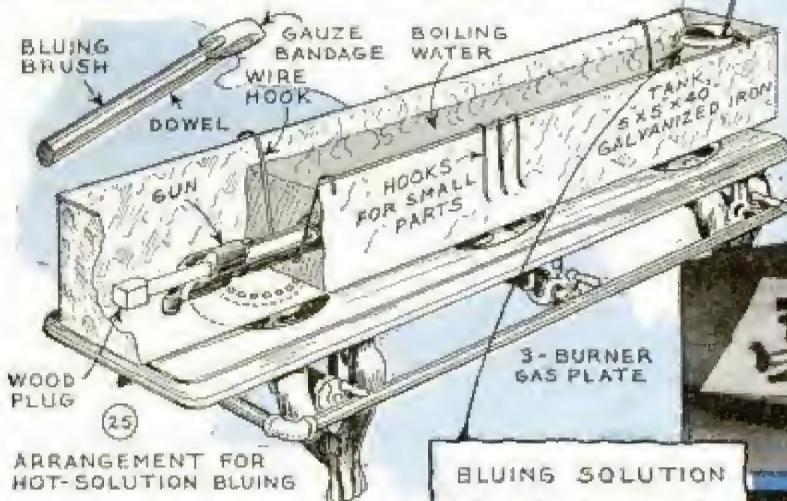


and also run in a line or two between points to serve as guides. With carbon paper, transfer the design to the wood, using a piece of flexible steel rule as a guide, Fig. 16.

Take the spacing tool and very lightly cut one of the point lines, running the cut right across the wood. Run in the corresponding line criss-crossing this. These are your two main guide lines. Work uniformly from these two lines, either to right or left. The tool is worked with a sawing motion, advancing about $\frac{1}{2}$ in. farther on every forward stroke. One set of teeth rides in the cut already made, while the other set marks a new line. Masking tape can be used to establish a straight guide line, Fig. 17. Finishing the design is simply a matter of using the V-tool and file. Use the spacing tool to cut a border all around the design. Finish by rubbing lightly with steel wool, which will polish the diamonds and remove any fuzziness.

Checkering the grip is much the same except that a pattern is useless. Use dividers to set off the points directly on the wood. Guide lines set off as shown in Fig. 21 will give you the $2\frac{1}{2}$ to 1 diamond shape. All checkering lines parallel these two guide lines. The checkering should not run too far under the grip, see Fig. 20, since this is an inside curve and very difficult to work. It is a good idea to split the design on top, as shown in Fig. 19. Fig. 18 shows a side view and Fig. 22 shows typical designs. Matting and beading combined with checkering produce an attractive pattern.

Gun bluing: A simple method of bluing is to spray with blue metallic lacquer, Fig. 24. This gives an appearance equal to any other method, but has the disadvantage of chipping and peeling off. It is quite useful for touch-up work. The set-up for regular hot-solution bluing is shown in Fig. 25. A second tank for a lye solution is useful, but one tank can be made to do the whole job



ARRANGEMENT FOR HOT-SOLUTION BLUING

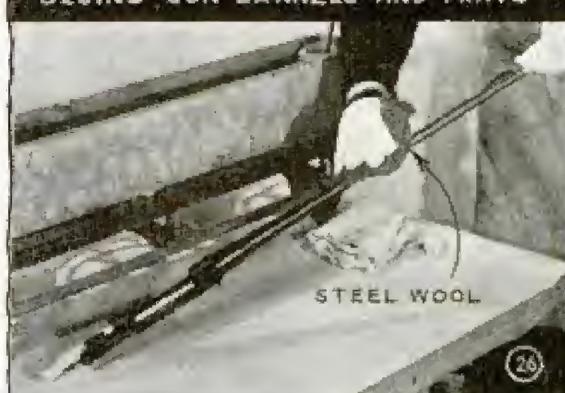
by cleaning between operations. Bluing solution can be purchased or made up according to the formula given. Start work by fitting boiled-wood plugs in both ends of the barrel. Dismount all loose parts. Scrub all parts thoroughly with gasoline. If there is old bluing on the gun, it can be removed with a 10-per-cent solution of sulphuric acid, flushing well with boiling water. Fill the tank two-thirds full of water and add a tablespoon of lye to each gallon of water. Bring to a boil. Place barrel and all parts in the tank and boil for 15 min. Flush the work with hot water and immediately after removal put it into a tank of clean, hot water. Do not touch the work with the bare hands. Wear cotton gloves or handle it by means of the wood plugs.

Now for the actual bluing. Put the bluing solution, 2 oz., in a clean glass jar and suspend in one corner of the tank. Fill the tank two-thirds full of water and bring to a hard, rolling boil. When the work is heated thoroughly, apply an etching solution made by adding nitric acid, $\frac{1}{2}$ oz., to water, $6\frac{1}{2}$ oz. Let stand 5 or 6 sec. and plunge back into the water. When the work is hot, remove and swab with the

SPRAYING WITH BLUE METALLIC LACQUER IS A QUICK METHOD OF GUN BLUING



BLUING GUN BARRELS AND PARTS



BLUING SOLUTION

Mix potassium nitrate, $\frac{1}{2}$ oz., sodium nitrate, $\frac{1}{4}$ oz., bichloride mercury, $\frac{1}{2}$ oz., and potassium chlorate, $\frac{1}{2}$ oz., in glass jar. Then stir in slowly distilled water, 10 oz., stirring constantly until almost cool, and add spirits of niter, $\frac{1}{2}$ oz. Keep in blue or brown glass bottle with glass stopper. Label poison and let stand 24 hrs. Shake well before using

bluing solution. As soon as it is dry, get it back into the water. After a minute or so, remove the work and scour off the rust with fine steel wool, as shown in Fig. 26. Now, put the work back into the water and repeat the operation—heat, blue, card off the rust. Three to five applications will give a rich blue-black coating. After the final coat, swab the work with linseed oil. Wipe this off carefully as it starts to gum on the cooling metal, and then oil with any light oil. The whole operation takes about $1\frac{1}{2}$ hrs. Speed in application of bluing solution is essential. All other operations can be done at ordinary working speed.

Note: Extreme care must be exercised in handling the etching and bluing solutions as they contain chemicals that are highly corrosive and poisonous. If accidentally spilled on the hands, immediately run copious amounts of water over them.

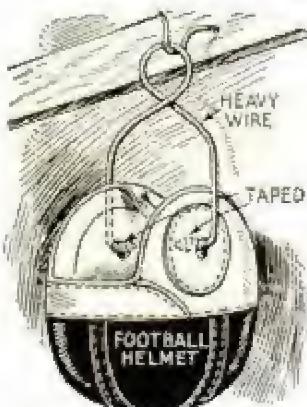
Brush Used in Different Paints Cleaned Economically



In my work of painting models, it is often necessary to use paints of different colors on a small job. To have a brush for each type of paint would not only raise the cost of production, but would also make a lot more work in keeping them clean. To avoid all of this, I use one brush and clean it on a piece of screen wire stretched over the top of a small box. To clean the brush, I merely dip it in a can of kerosene or other solvent and then rub it back and forth across the screen. In this way, the solvent or cleaning fluid does not become colored quickly, as the brush is merely dipped in and out once or twice for each cleaning.

—C. H. Dyer, Pikeville, Ky.

Helmet Hanger Saves Space



instead of using shelves. Also, the hangers make it possible for the helmets to dry out quickly after a hard-played game. The

lower ends of the hanger are either taped or covered with rubber tubing to prevent damaging the helmets.

—James H. Gosch, Scotia, N. Y.

Light Bulb Serves as Float on Valves

An old light bulb serves nicely as a float on automatic float valves. A socket should be installed on the end of the float arm and the bulb screwed into it. Size of the bulb will be determined by the buoyancy required.

—Wit C. Casey, San Diego, Calif.



Tin-Can Stilts Are Lots of Fun



Tin-can stilts are inexpensive and are safe for children, especially the small tots who want in on the fun. The cans are held on the shoes by rubber bands cut from old inner tubes.

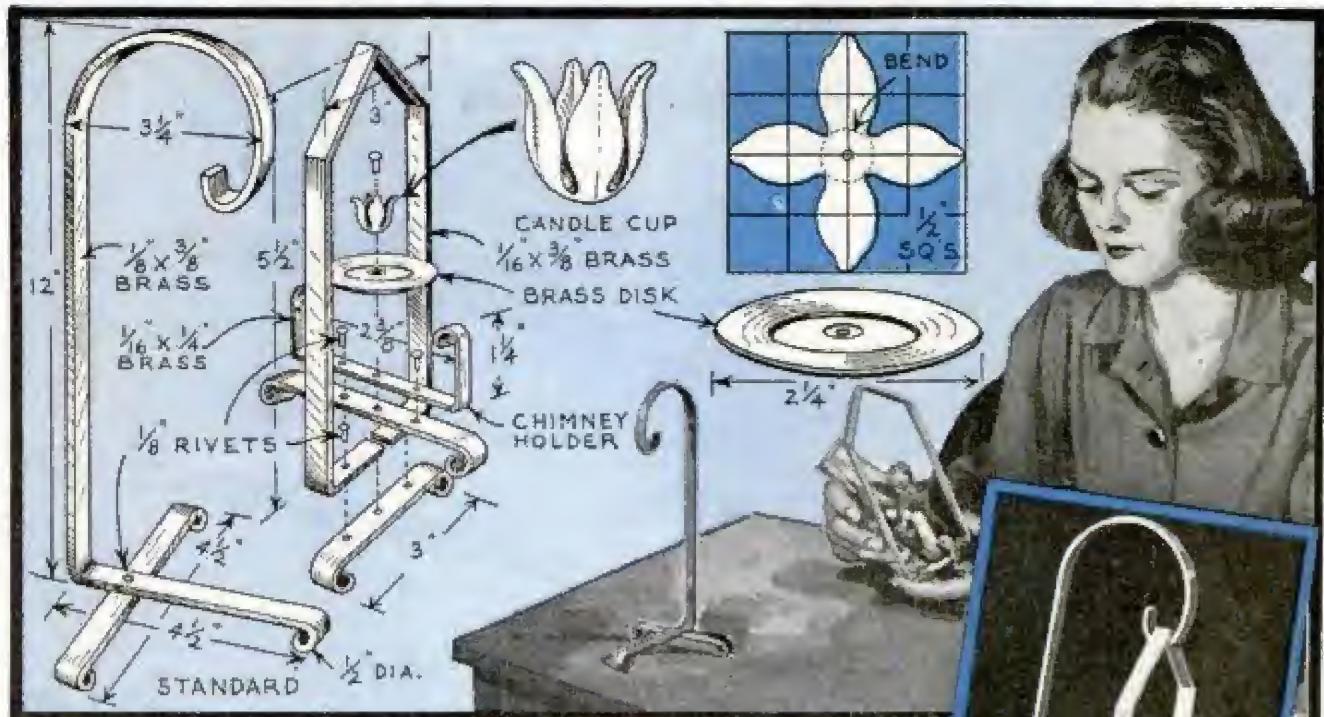
Rubber Ball Shields Hand When Filing Saw

A saw filer's hand can be protected easily against injury on the sharp teeth by fitting the file with a guard made from a small sponge-rubber ball. A hole punched through the center of the ball permits it to be slipped on or off the file in a jiffy.

—Howard R. Heydorff, Missoula, Mont.



Stand and Chimney Make Hurricane Lamp

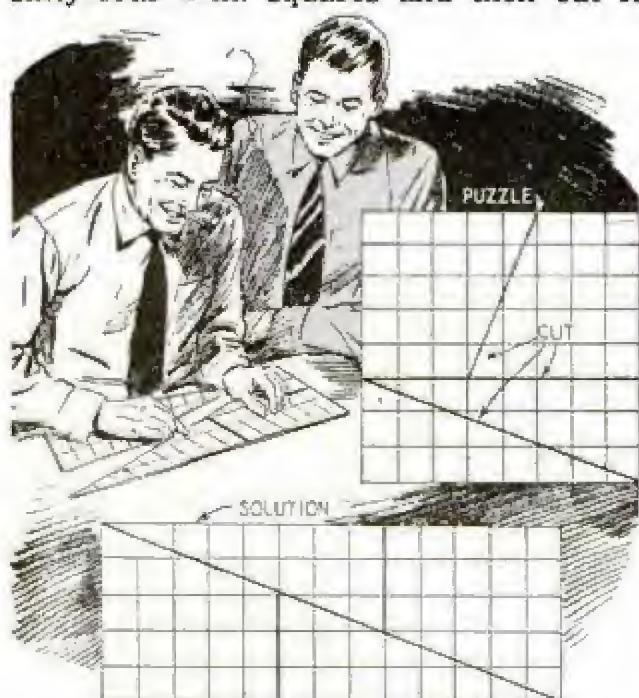


Just the thing in your colonial or knotty-pine room, a candle lamp like the one shown is made easily by anyone, and comes in handy when your electric current is cut off temporarily by a storm. A hack saw and a small vise or jig to cut and shape the brass framework, and a pair of snips to cut the sheet-brass chimney base take care of the tools. You can buy the chimney at a hardware store. The brass can be left unprotected to tarnish and give the appearance of age, or it can be polished and lacquered.



Where Does the Extra Square Come from in This Puzzle?

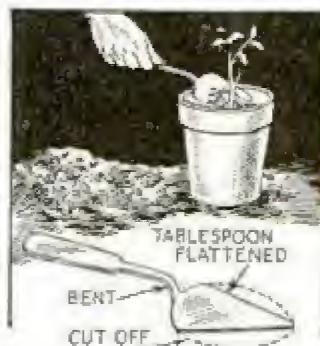
Does it seem possible to take a piece of heavy cardboard 8 in. square, lay it off in sixty-four 1-in. squares and then cut it



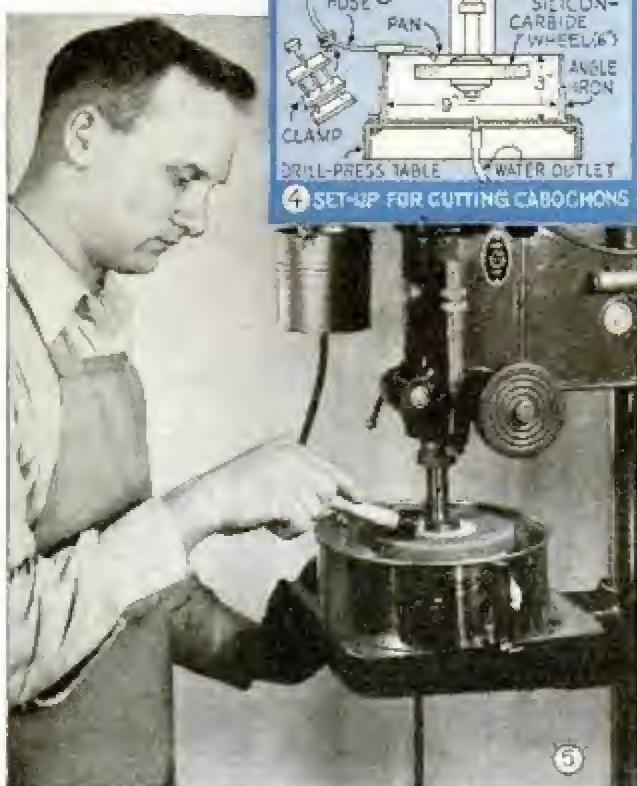
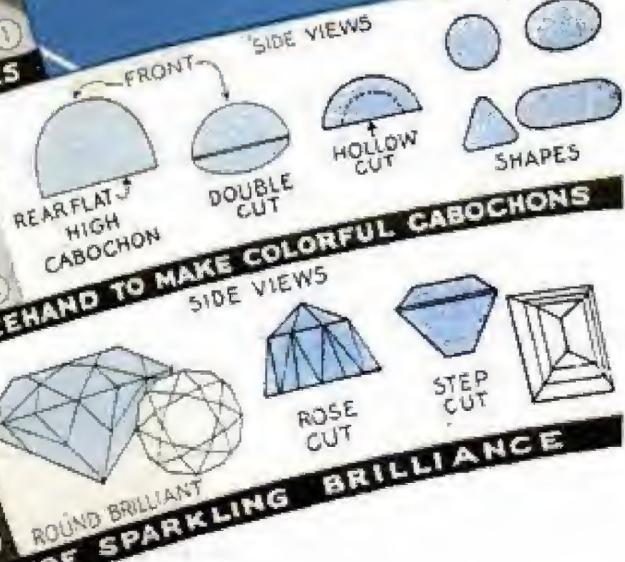
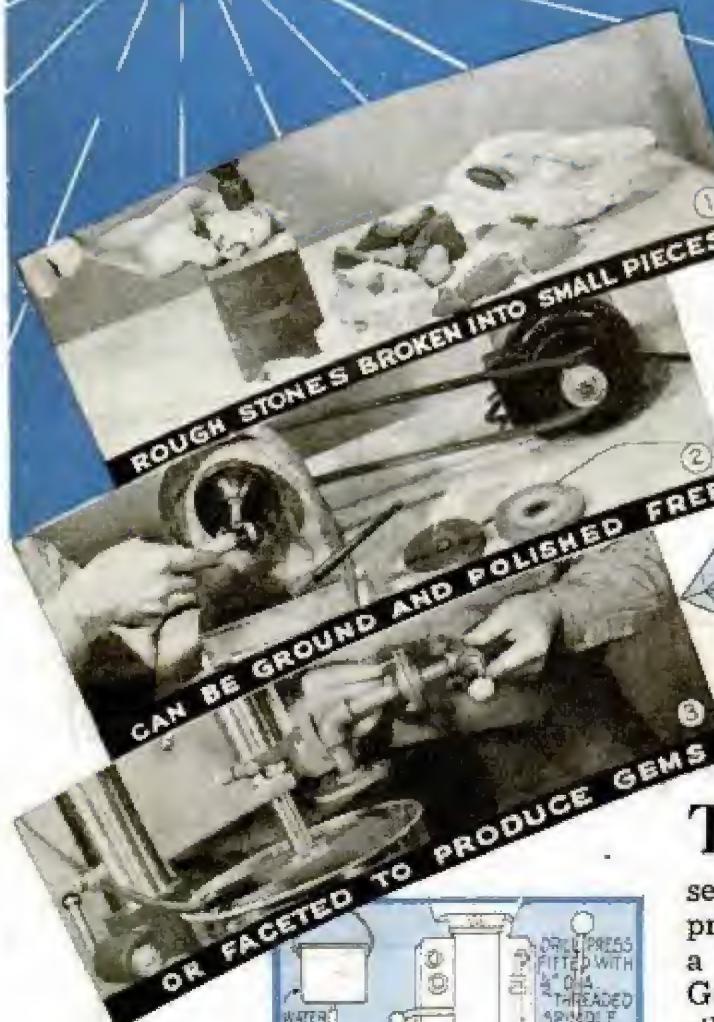
into three parts, which are then arranged in a rectangle having sixty-five squares? That is what apparently happens if you cut the cardboard as indicated in the upper detail and then arrange it as shown in the lower one. The secret is that while the three pieces appear to fit together closely, there is enough space along the three joints to equal a square inch of surface.

Garden Trowel Made from Spoon

A good garden trowel can be made from a large spoon, the bowl of which is cut as indicated. Such a trowel will also be handy for doing small pointing jobs on masonry.



GEM CUTTING

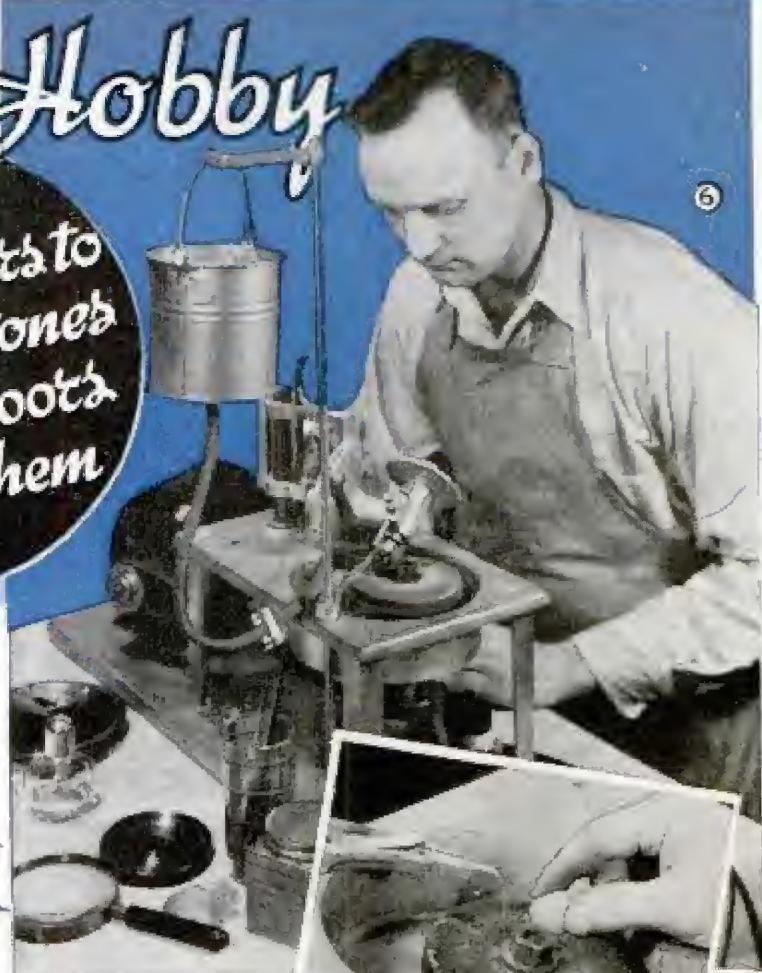
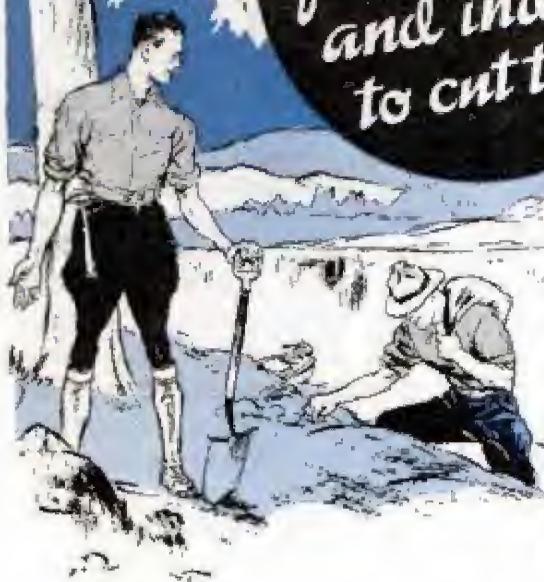


THERE'S a real fascination in cutting and polishing semi-precious stones. A set-up for cutting cabochons on a drill press is shown in Figs. 4 and 5. Start with a $\frac{3}{4}$ -in. round button, about $\frac{3}{8}$ in. high. Grind this roughly to shape on a 100-grit silicon-carbide wheel, running a small stream of water on the wheel. Grind one side of the stone perfectly flat, as in Fig. 8, and cement the stone to a short length of dowel rod. A cement for this can be made by mixing sealing wax, 3 parts, with flake shellac, 1 part. The mixture is made fluid by heating. Dip the end of the dowel (lap stick) into the hot cement, and, with moistened fingers, build up a ball of cement, as in Fig. 9. Pick up some cement on the flat side of the stone and press in place on the end of the stick. Have all parts warm before applying the cement, by holding the lap stick and the gem over a flame. Then proceed to grind it further, turning on the water, as the wheel will glaze in a few minutes if dry, and heat may fracture the stone. Further smoothing can be done on a 180-grit silicon-carbide wheel, or, you can jump to the next operation, done on a cast-iron lap.

The cast-iron lap wheel should be 6 in. in diameter by 1 in. thick. One side is flat and the other is hollowed out. This wheel

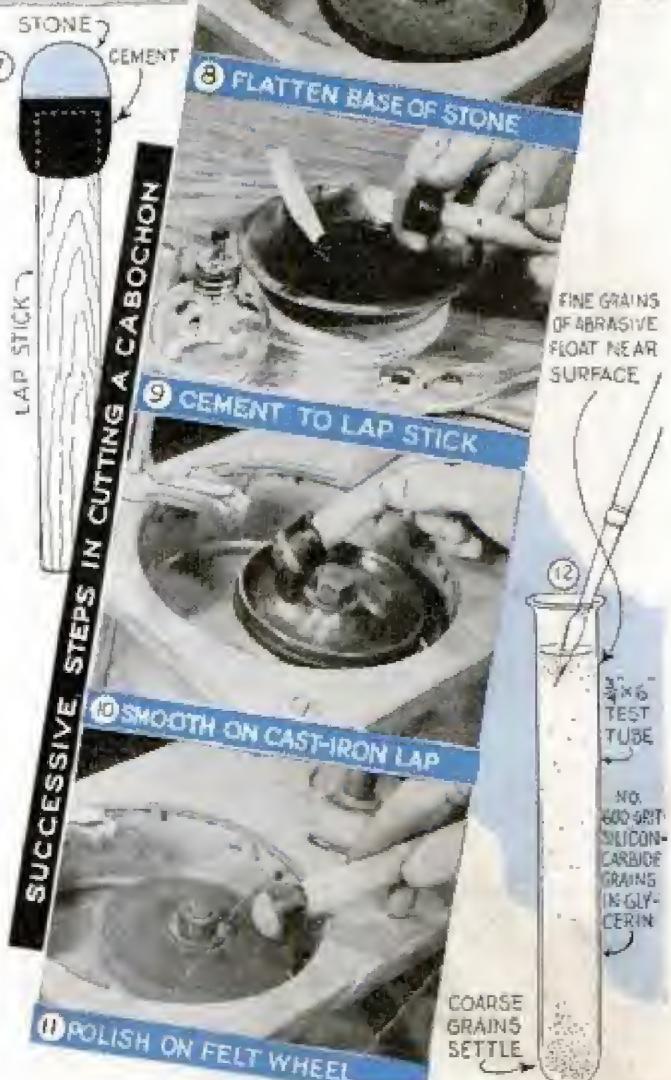
A double Hobby

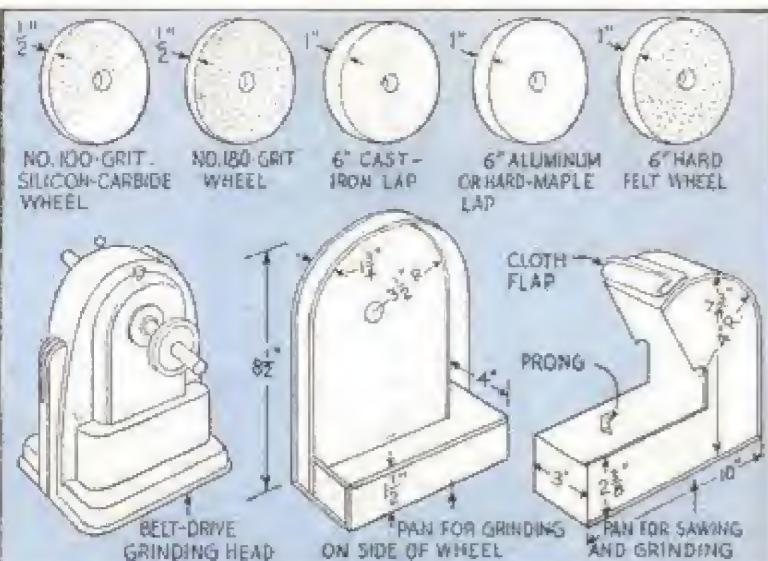
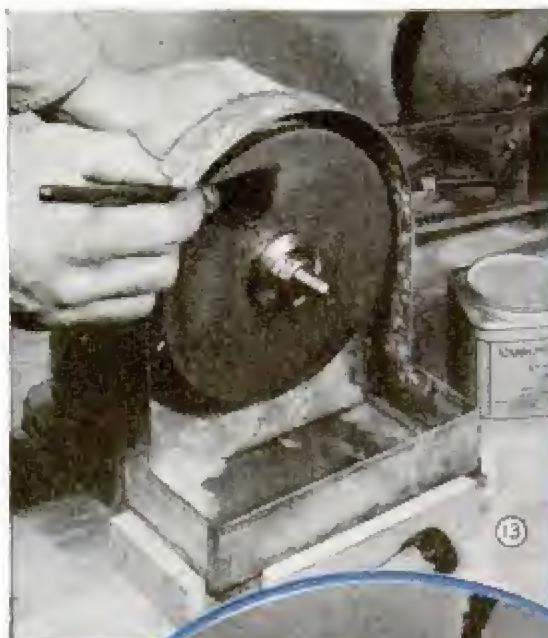
-- takes
you outdoors to
find the stones
and indoors
to cut them



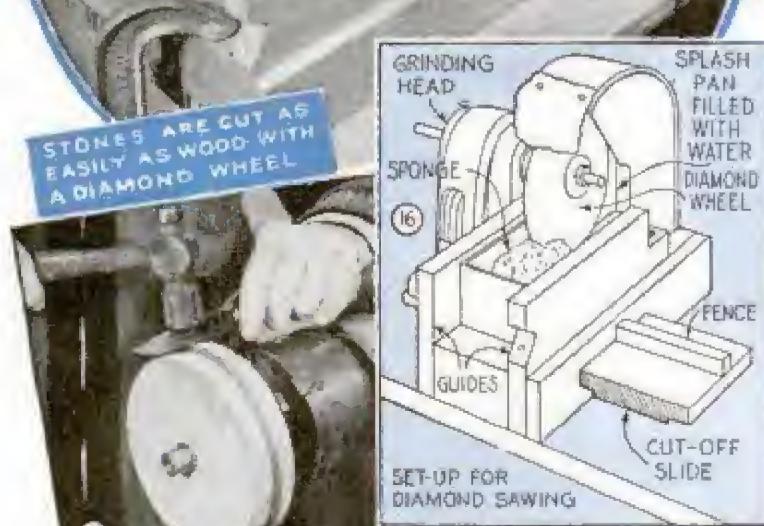
is lubricated with No. FF silicon-carbide grains mixed with water to form a paste, applied with a brush. After making the stone smooth, wash the lap with water and apply a paste of 600-grit silicon carbide. If the abrasive grains are mixed with glycerin and kept in a test tube, as in Fig. 12, the very fine grains will float near the surface, thus providing a graduated abrasive for final polishing. A further polish can be obtained by using a softer lap, as aluminum or hard maple. Final polishing is done on a hard felt wheel, lubricated with a paste made from No. FFF pumice and water as in Fig. 11. Wheels with paste abrasives should run at 600 to 1,000 r.p.m., using as much speed as possible without throwing the abrasive off the wheel. Grinding wheels can run at any speed from 1,000 to 3,600 r.p.m.

All operations can be done on an inexpensive grinding head, as shown in Figs. 13 and 14. Each wheel or lap should have a separate splash pan so that the abrasives can be kept separate. Lubrication for grinding is supplied by filling the splash pan with water or kerosene so that the wheel is immersed about $\frac{1}{2}$ in. Sheet tin or zinc cemented to a hardwood wheel can



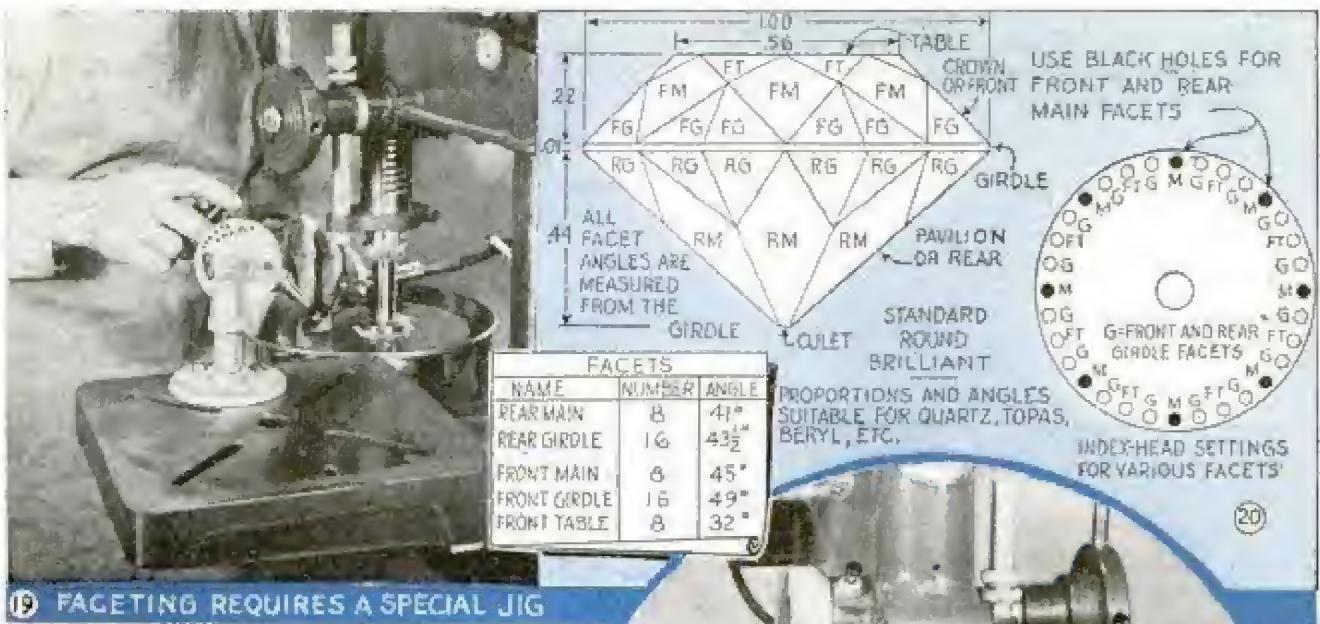


14 EQUIPMENT FOR GEM CUTTING ON HORIZONTAL SPINDLE



be used instead of solid metal laps. Similarly, $\frac{1}{4}$ -in. felt can be glued to wood as a substitute for a solid felt wheel. Battleship linoleum glued to wood wheels makes up nicely as a smoothing lap when used with No. FF grains. Dry sanding with 180 to 220-grit silicon-carbide paper on a disk sander is an optional method of treatment for intermediate polishing. For final polishing with muslin, leather or felt buffering wheels, a number of soft abrasives are available, including tin oxide, red rouge, green rouge, pumice stone, rottenstone, etc.

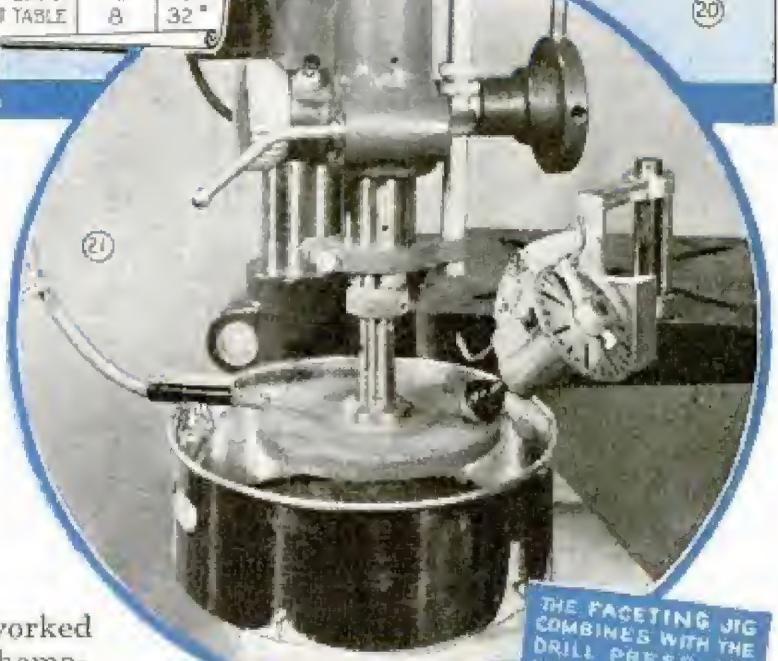
A suitable rig for sawing large stones into smaller pieces is shown in Figs. 15 and 16. The best type of wheel for sawing is a copper disk impregnated with 50-grit diamond grains (bortz), costing about \$2 per carat. About $\frac{1}{4}$ carat will charge the 6-in. saw. Charging is done by nicking the rim of the disk with a knife, as shown in Fig. 17, after which the diamond grains, mixed with vaseline, are gently hammered into the cuts. A hard piece of stone is pressed firmly against the wheel while it is revolved by hand, bedding the grains firmly and giving the saw a considerable set. A properly charged diamond saw will cut gem stones almost as easily as a steel saw cuts wood, and, under normal conditions, should have a life of from 500 to 1,000 sq. in. of cut. The saw must always run wet, using either water or kerosene as a lubricant.



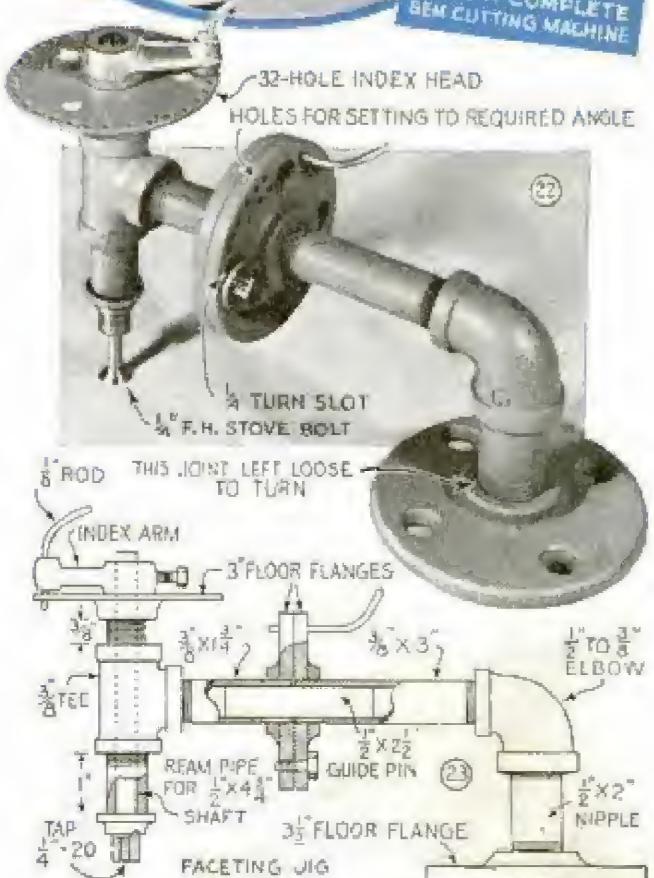
19. FACETING REQUIRES A SPECIAL JIG

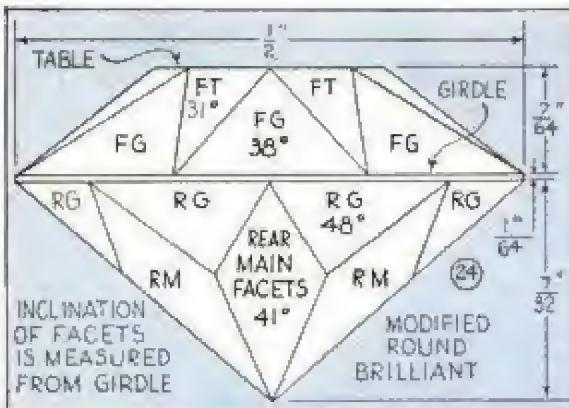
Most transparent stones are faceted to obtain a better return of light, while opaque and translucent stones are cabochon cut. Fig. 20 shows the most common form of faceted gem—the standard round brilliant having 56 facets. To obtain an accurate setting for all of these various faces, a special jig is required. A small gem-cutting machine with faceting attachment, is shown in Fig. 6. Good results can also be obtained with a commercial faceting attachment worked on the drill press, Fig. 21, or with a home-made faceting device, as in Figs. 19, 22 and 23. Any faceting attachment must have four movements: (1) an indexed movement around a complete circle, (2) a 90-degree movement with settings at various intermediate positions, (3) a swing movement across the face of the stone, (4) an up-and-down movement to permit feed. The last movement is not required when the jig is worked on the drill press as the drill-press mechanism provides for feed. Figs. 22 and 23 illustrate a simple jig which embraces the first three movements mentioned. All facet angles of a gem are measured from the girdle. Hence, the angle formed by the index shaft and the grinding wheel will be the complement of the facet angle. The most common angle settings are those required for cutting the two stones shown in Fig. 20 and Fig. 24.

Your first faceted gem should be a modified round brilliant about $\frac{1}{2}$ in. in diameter, as in Fig. 24. This has four banks of 8 facets, or a total of 32 facets. Rough-grind the stone by hand, flat on one side and as



THE FACETING JIG COMBINES WITH THE DRILL PRESS TO MAKE A COMPLETE GEM CUTTING MACHINE





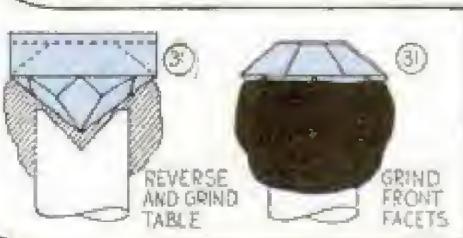
nearly a $\frac{1}{2}$ -in. cylinder as you can get it. Crystal quartz is cheap. Cement the stone to the lap stick (metal in this instance) as in Fig. 25. Set the facetting jig at 41° , this being the angle of the rear main facets. Lower the gem to the grinding wheel and spin the index arm until the stone comes to a perfect cone shape, as in Fig. 26. Now cut the eight rear main facets. Leave the angle setting as it is. Set the index head pin in any of the "M" holes (see Fig. 20). Contact the grinding wheel and grind until the facet point coincides with the point of the cone. Change the index head setting to the next "M" hole and repeat, and so on until the eight facets have been cut. The stone will now look like Fig. 27. Change the angle setting to 48° and grind the eight rear girdle facets, using the index head holes which come between the "M" holes. The stone will now look like Fig. 28, while Fig. 32 shows the operation. The photo shows the work being done dry to avoid confusion, but in actual practice the wheel would



run wet. It should be noted also that the rotation of the drill press has been reversed from that ordinarily used.

After rough grinding the rear facets, all operations are repeated, as in the cabochon cut, to bring the surfaces to a perfect polish. After this has been done, the girdle is cut on the rim of the wheel, as in Figs. 29 and 33. Then the stone is reversed. Proper alignment is important, and is best obtained by using a lap stick with a conical recess, as in Fig. 30. The table is ground and polished, as in Fig. 34, after which the front facets are cut and polished the same as described for the rear facets.

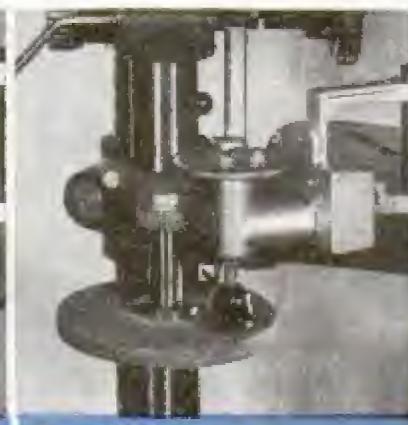
The entire operation of cutting and polishing a faceted gem requires from 4 to 6 hrs. It is important that each of the operations from coarse to fine abrasive should be carried out to the fullest extent. The gem should be dried for inspection as a wet surface appears polished when it is really quite dull. Judge the polish by reflection. When you can pick up a clearly defined image of a light bulb or a window on the surface of the stone, you can be sure it is truly polished.



32 GRINDING REAR GIRDLE FACETS

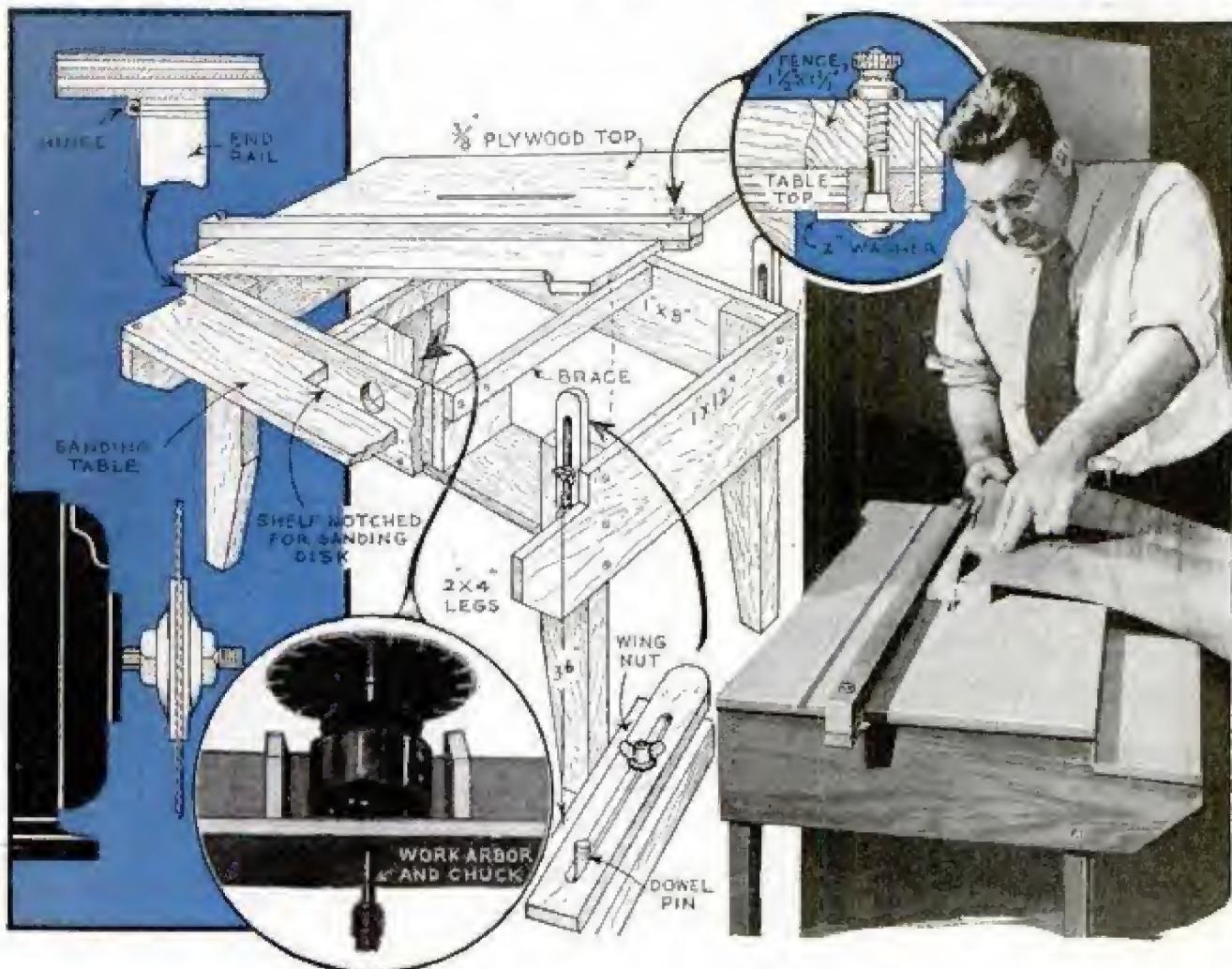


33 CUTTING THE GIRDLE



34 CUTTING THE TABLE

Direct-Drive Table Saw Has Variety of Uses



Sawing is just one of the many operations which can be done on this sturdy homemade table saw. In addition, sanding, drilling, grinding, buffing and carving are possible by equipping the motor with a standard work arbor and chuck to accommodate standard accessories. A $\frac{1}{2}$ -hp. double-shaft 1,750-r.p.m. motor, equipped with a 12-in. combination saw blade, is recommended. The motor shaft may be threaded to take the blade as shown here, or a $\frac{1}{2}$ -in. work arbor may be used. In the latter case, be sure to pin the coupling securely to the shaft to prevent the arbor from working

loose. To provide the maximum depth of cut, the hinged top is adjustable for the desired cut and to allow convenient access to the motor. The height of the motor shelf should allow the top of the motor to just touch the underside of the plywood table. While the use of a thicker panel for the top will reduce the cut, it will permit a groove to be made in its surface for a standard miter gauge. The fence is set parallel with the saw by clamping it an equal distance measured from the front and rear edges of the blade.

—Robert L. Eby, La Grange, Ill.

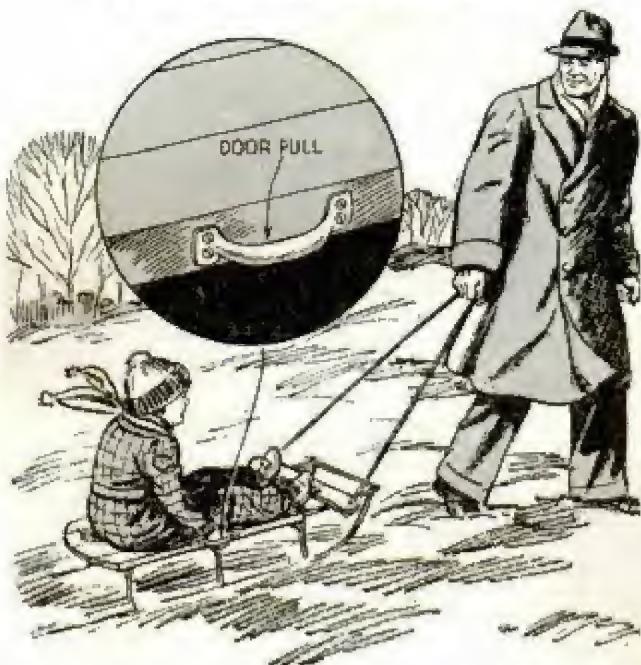
Broken Slats in Venetian Blind Replaced without Taking Blind Apart

Broken slats in venetian blinds may be replaced without taking the blind apart. First remove the broken slat, using a coping saw if necessary. Prepare a substitute slat of the proper dimensions and extend the cord slots all the way to one edge as shown in the photograph. Then the slat can be slipped in place easily.

—Morris Katz, Aurora, Ill.



Screen-Door Pulls on Sled Protect Child's Hands

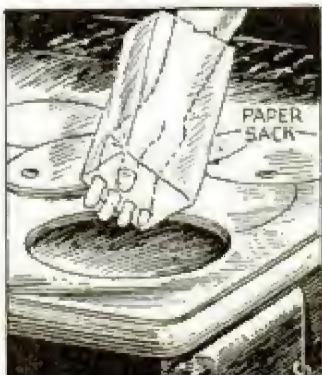


To protect a child's hands from possible injury when riding on a sled, screen-door pulls can be attached to the hand rails. These will shield the hands from contact with other sleds or stationary objects that might otherwise cause severe accidents.

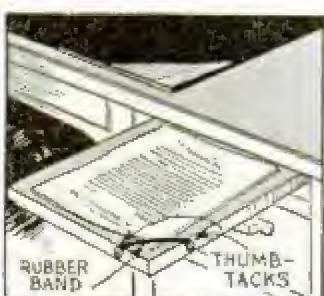
—G. E. Hendrickson, Argyle, Wis.

Paper Bag Is Emergency Mitten When Cleaning Stove

A paper bag provides an emergency mitten to protect your hand and coat sleeve from soot when removing clinkers from a stove. Just punch finger holes in the bottom of the bag as shown.



Rubber Band on Desk Slide Keeps Papers in Place



To prevent papers from being brushed or blown off a desk slide, slip a rubber band over the outside corner and fasten it in place with a couple of thumb-

tacks. This will not interfere with opening or closing the slide, and the corners of the papers may be inserted under the band to hold them in place.

Spring-Type Clothespin Is Clamp for Modelmakers

Modelmakers will find this little clamp helpful in assembling tiny parts. It consists simply of a spring-type clothespin pivoted to a deep U-shaped piece of metal,

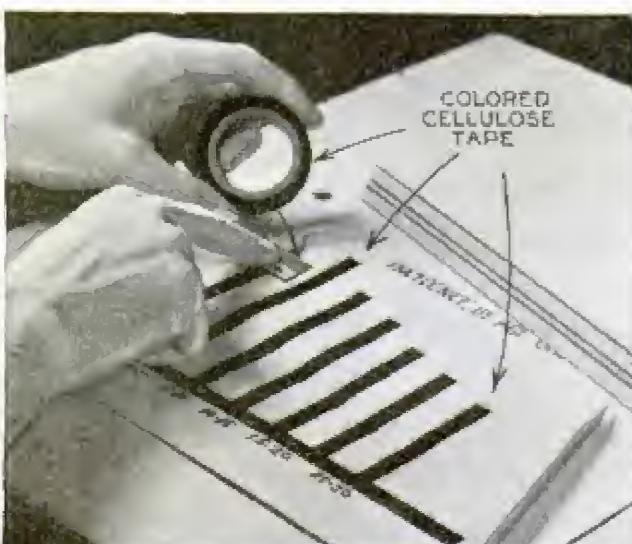


which is fastened to a small base to support it. A wing nut on the pivot bolt simplifies adjusting and locking the clamp at various angles.—W. C. Wilhite, Carlinville, Ill.

Tape Used to Make Bar Graphs

In school and scientific work where large bar graphs are often needed, the work of making them can be reduced considerably by using tape to make the lines, instead of ink. Ordinary binding tape is used when black lines are desired, while colored cellulose tape can be used when colored lines are necessary.

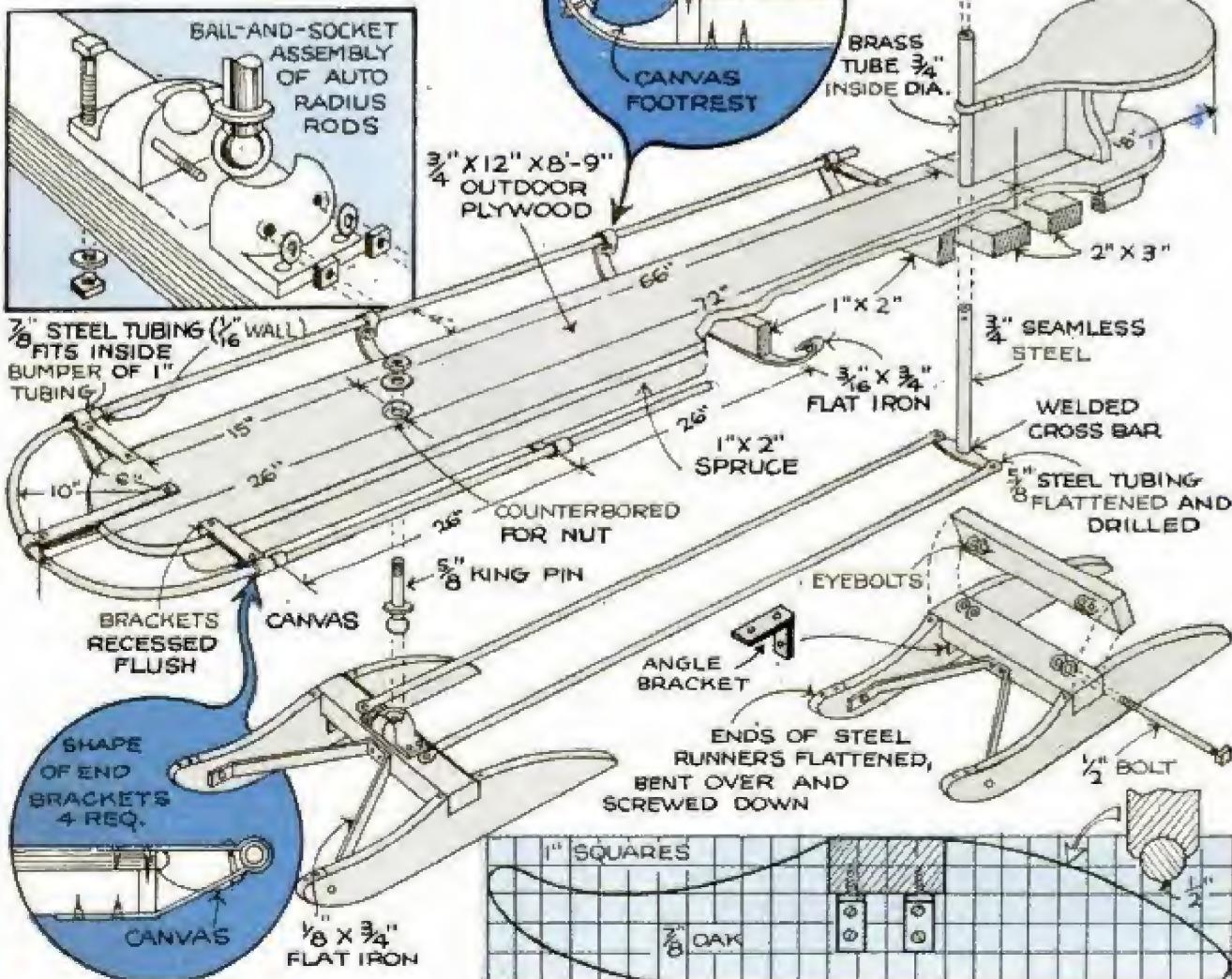
—Evan Wright, Topeka, Kan.



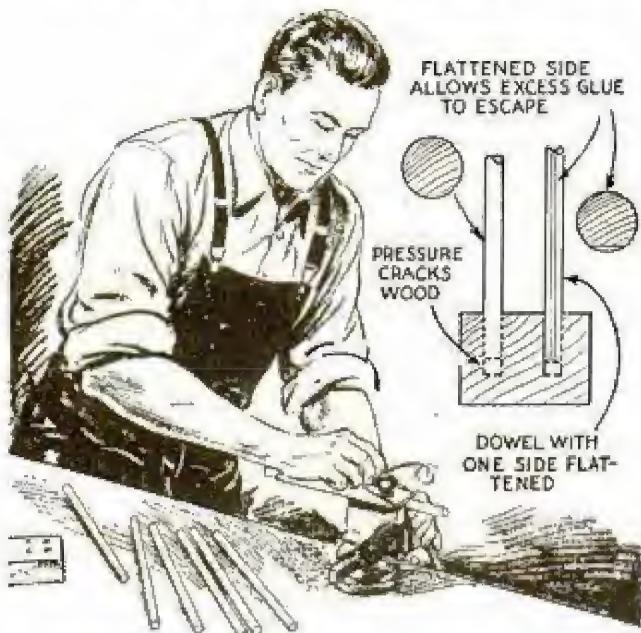
"Payload" BOBSLED

has pilot's seat at rear

Steered from the rear, this sled has more room than the conventional type of the same size, as space forward, which ordinarily would be occupied by the steering gear, is utilized for a passenger. Also, this design permits placing the sleds closer together, which makes steering easier, and the pilot has a clear view over the heads of the passengers. Construction is relatively light without sacrifice of strength. The steering gear consists of a standard auto wheel mounted on a steel-tube post having a crossarm welded on the lower end to which tie rods are bolted. The front sled turns on a ball-and-socket joint, permitting it to follow uneven contours without strain on the chassis. This joint consists of a king pin with an integral ball and collar, and a steel socket split and assembled with bolts. The ball-and-socket joint taken from the radius rods of a model-T Ford can be adapted to this purpose. The sled runners are 14 in. apart and the rear sled is connected to the chassis with a long bolt through eye bolts in the upper and lower cross members.



Dowels Flattened on One Side to Provide Air Vents

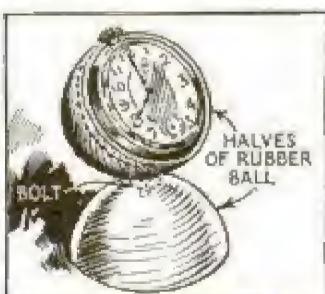


Slightly flattening one side of a dowel on a sander or with a plane takes only a few seconds, yet saves time and helps avoid damaging the work when using the dowel. The flattened surface allows air to escape from the hole when it is driven so that there is no danger of the air becoming compressed and causing the work to split.

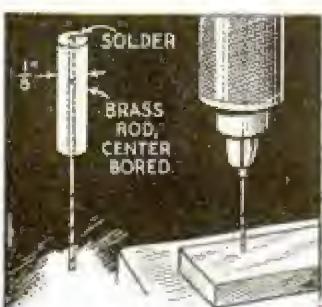
—H. Rosenberg, Philadelphia, Pa.

Rubber Ball Protects Watch

If a watch must be kept at hand on a bench or machine where it might be damaged by acids or vibration, a holder made from a hollow rubber ball as shown will help protect it. A notch cut in the upper section of the ball to receive the stem of the watch holds it in position.



Adapter to Use Tiny Drills in Standard Drill Press

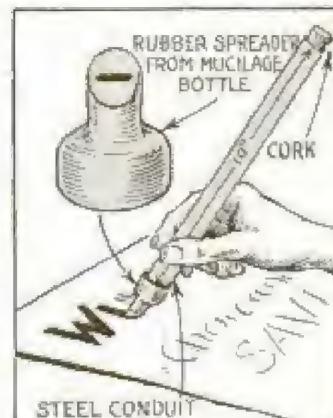


Modelmakers need not purchase an expensive auxiliary chuck to adapt pin drills for use in a standard drill press, as this simple adapter makes possible

their use for an occasional job. It is made from a length of 1-in. brass rod, which is centerbored with the size of drill you intend to use in it. The drill is held in the adapter by merely inserting it in place and then applying solder from the opposite end. The solder acts as a safety clutch, for it will pull away when a heavy load is placed on the drill, thus reducing the chances of breaking and allowing the drill to stall while the chuck continues to rotate.

Spreader from Mucilage Bottle for Sign Painting

Having a number of signs to get out in a single color, one sign painter used the fountain "brush" shown. It is made by slipping a rubber spreader from a mucilage bottle over one end of a length of steel conduit and corking the other end. The slit in the rubber is made slightly larger to allow the paint to flow freely.

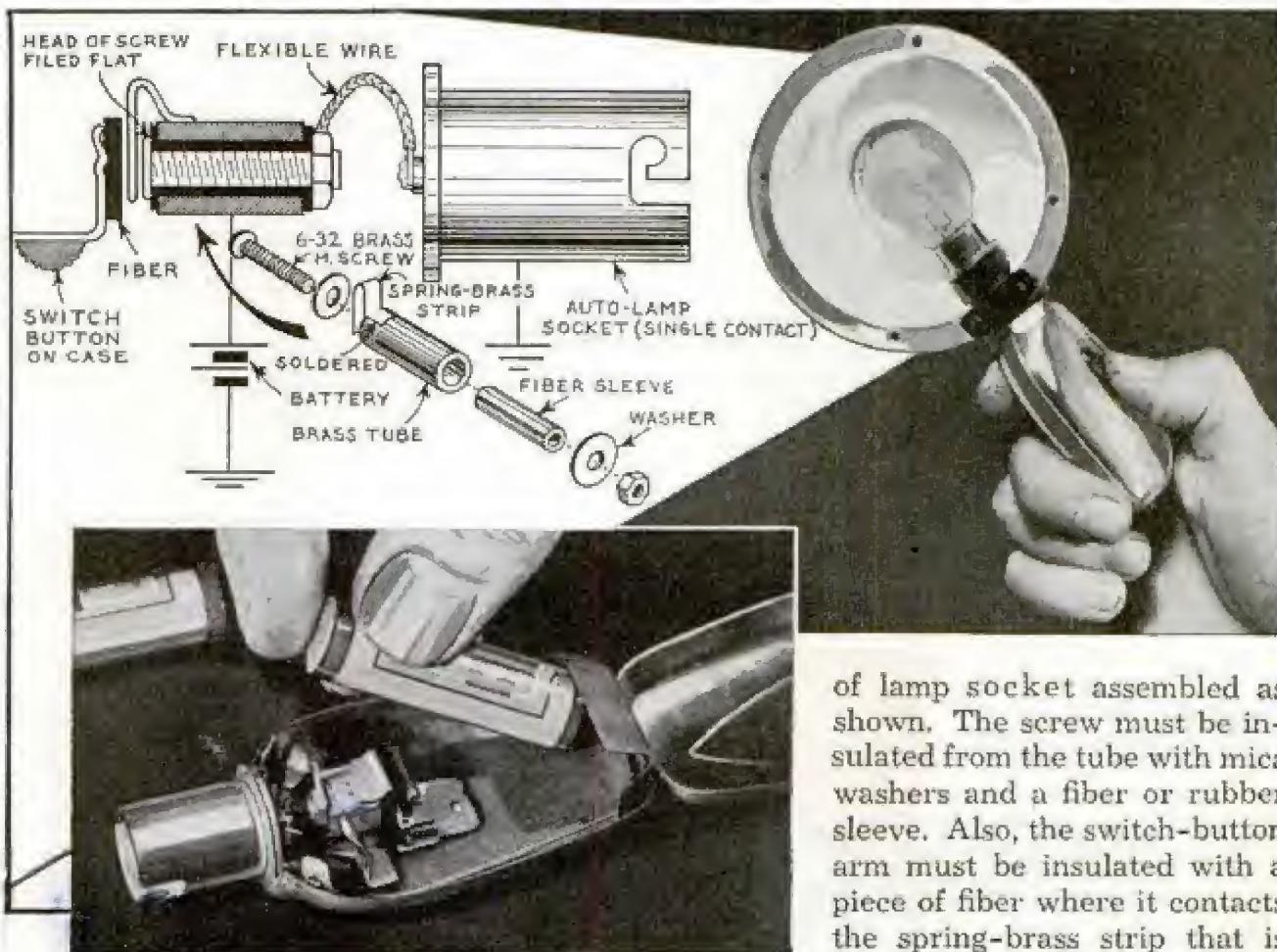


Curtain Rod Is Good Straightedge When Cutting Glass

Instead of trying to use a ruler or a yardstick in cutting glass, use flat, metal curtain rod, which is much superior for the purpose. The edge is true and does not have a tendency to impede free movement of the cutter as a ruler does. Also, with but slight pressure it will remain in position on the glass without slipping.



Midget Photoflash Gun Carried in Your Pocket



With the introduction of small photoflash lamps it is possible to make a pocket-size gun from a small flashlight by replacing the lamp and socket with the parts indicated. These consist of a brass tube, brass machine screw and an automotive-type

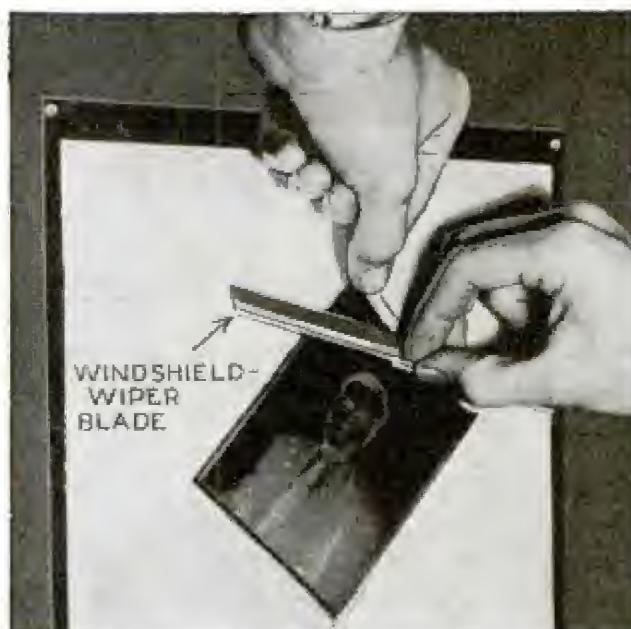
of lamp socket assembled as shown. The screw must be insulated from the tube with mica washers and a fiber or rubber sleeve. Also, the switch-button arm must be insulated with a piece of fiber where it contacts the spring-brass strip that is soldered to the tube. Be sure that the automotive socket is soldered to the flashlight case to make good electrical contact. The reflector was made from an egg poacher obtained at a dime store. A short brass tube attached to the reflector permits it to slip on or off the socket.

Excess Water Wiped Off Negative with Windshield Wiper

Negatives will dry more quickly if most of the excess water is removed from them before they are hung up. A handy method to do this is to tack a large piece of celluloid to the wall over the darkroom sink. Wet negatives are placed against this and wiped with a windshield-wiper blade. After one side is wiped, the celluloid is given a downward wipe so there will be no water on it to get on the dry side of the negative when it is turned over. I have found this method faster and more effective than using a sponge.

—Charlie Mihn, Hollywood, Calif.

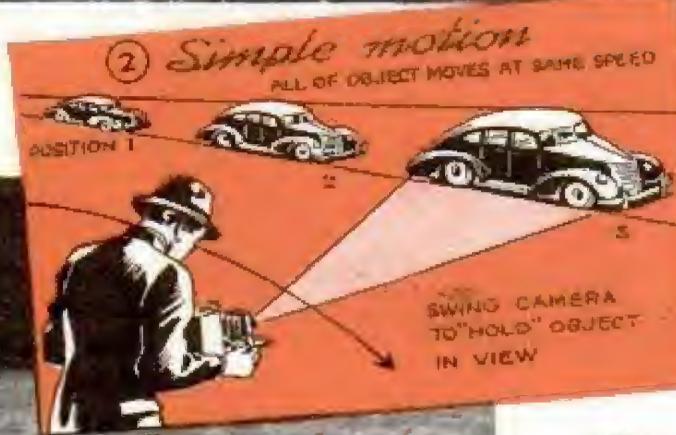
Use only specially prepared photographic blotters to dry prints; ordinary blotters may stain a print or cause it to fade.



You can get those



To stop the motion of this plane as it was taking off required an exposure of one-thousandth of a second



Exposure Required to Limit Object Movement to 1 Inch

MPH	Exposure
120	1/2000
60	1/1000
30	1/500
15	1/250
12	1/200
9	1/150
6	1/100
3	1/50
1.5	1/25
0.6	1/10

When at right angles to objects of fast motion, you swing the camera to keep them in the view finder and snap the shutter when they reach the position for which the camera was focused

speeds. Figs. 1, 2, 3 and 7 illustrate simple motion, while Figs. 5 and 6 illustrate compound motion.

The table at the right of Fig. 2 gives an idea what ex-

posure speeds are necessary to limit the movement of objects traveling at various speeds to one inch of movement during the interval of exposure. For large objects such as airplanes, several inches of movement are allowable but for small objects with fine detail even a 1-in. movement may be too much for good results. In the latter case the photographer lessens the exposure time as may be necessary in each particular case to reduce still more the space traversed by the object. It must be remembered that the exposure speeds in themselves disregard light conditions,

By THOMAS P. LAKE

CORRECT shutter speed, the use of angles to reduce apparent object speed, and "frozen action" are three important factors in getting good action photos. Without them you may often miss exciting picture possibilities.

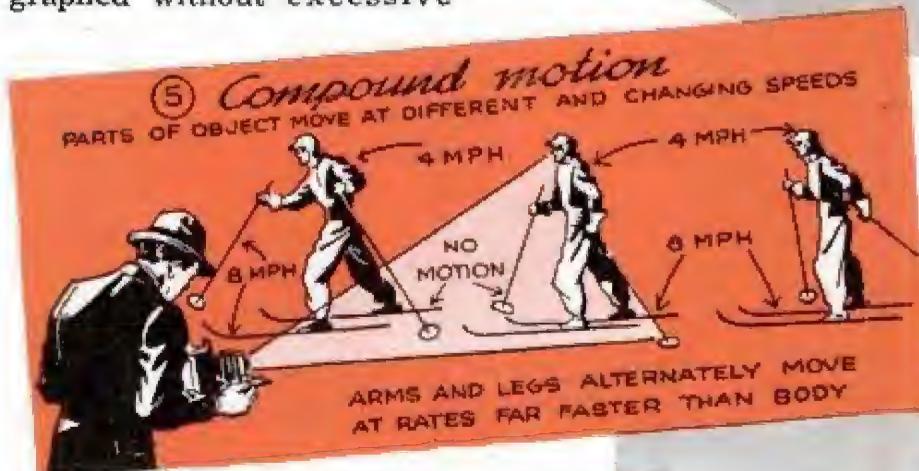
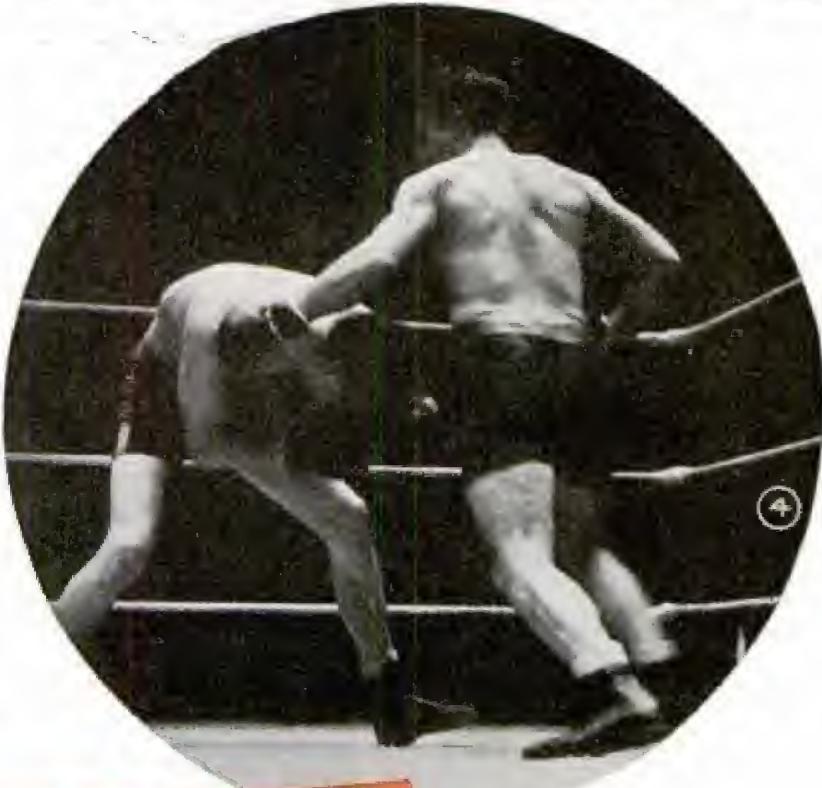
In analyzing motion for the purpose of "stopping" it in photography, it may be simple motion, in which all parts of an object move at the same speed, or it may be compound motion, in which different parts of an object move at different and changing

"FROZEN-ACTION" SHOTS

which must be met with lens opening and proper emulsion.

In cases where you photograph objects displaying compound motion, you estimate the fastest motion and make your exposure to suit. For example, the body of the skier in Fig. 6 may be advancing at a rate of about 4 m.p.h., but, while one leg is practically at a standstill, the other one is advancing more than twice as fast as the body movement. So you estimate a 10 m.p.h. speed to arrest leg movement, and make your exposure accordingly.

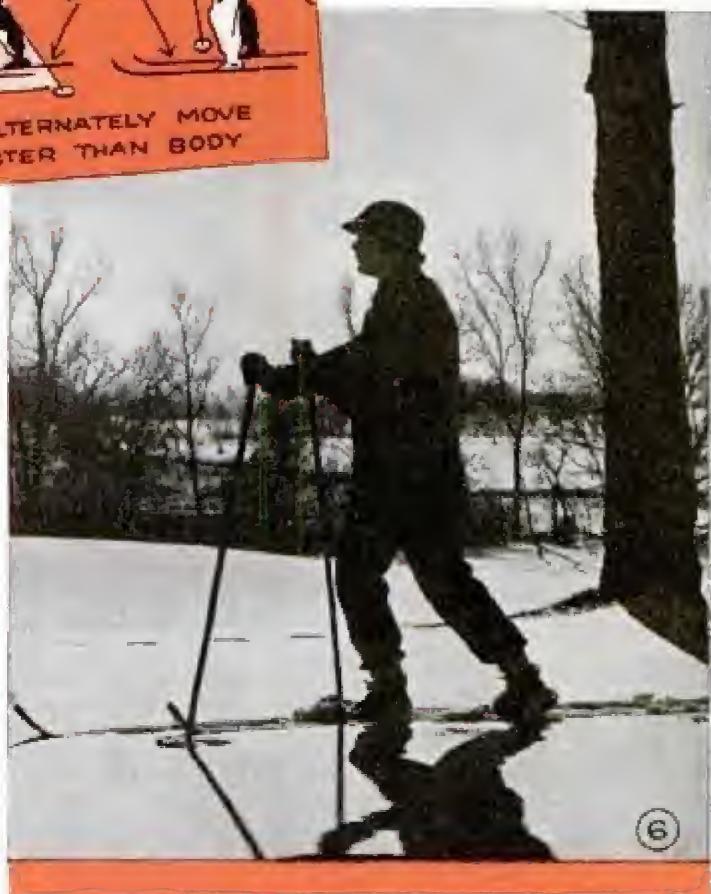
When the speed of an object is too great to be photographed without excessive

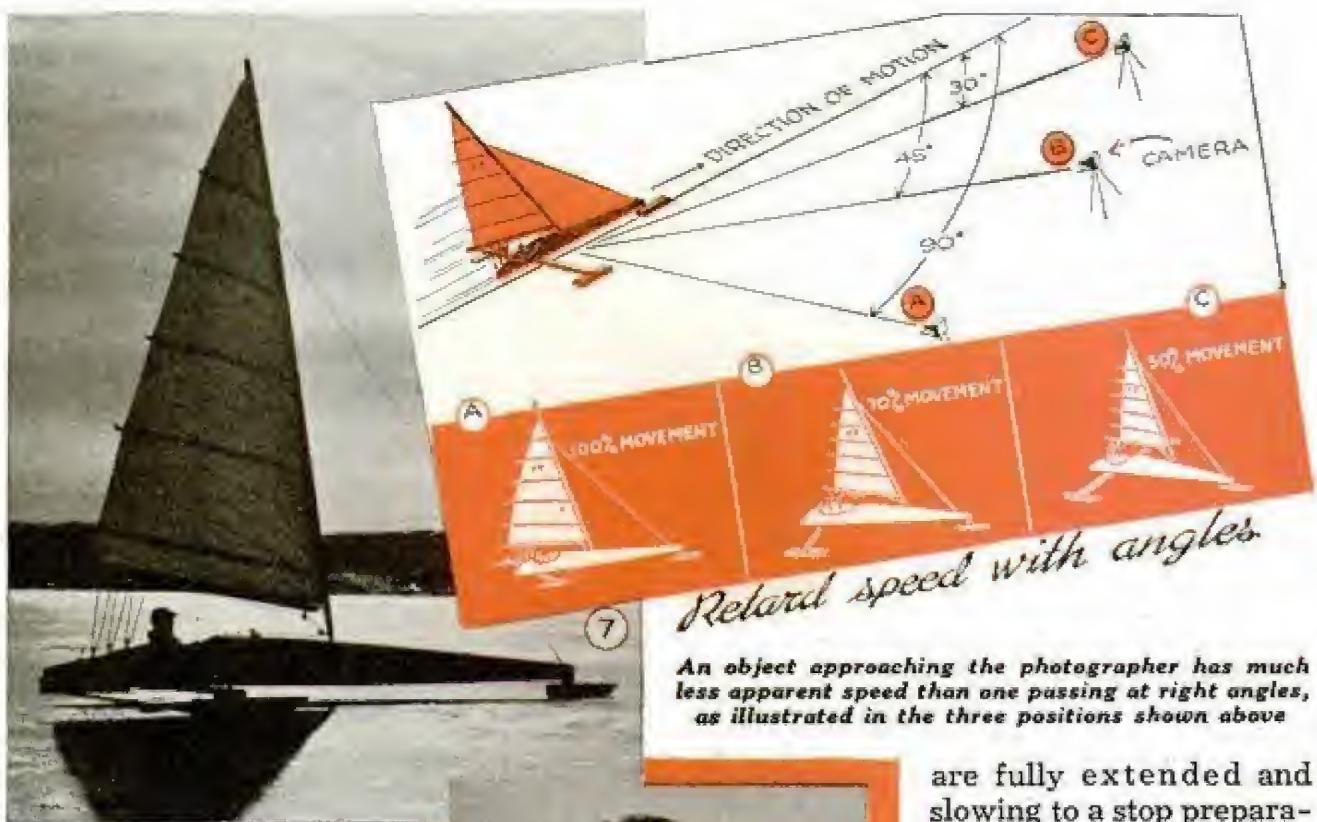


Exposure above caught the arm of the boxer the instant of impact, yet failed to stop the motion of one foot, which is slightly blurred as a result

In photographing objects displaying continuous compound motion, exposure time must be planned to arrest movement of the fastest part

blurring due to movement during exposure, it is still possible in many cases to obtain satisfactory pictures. This is accomplished, as in Fig. 7, by taking the picture at an angle less than 90° . The speed of the object is unchanged, but the movement of the image over the negative surface is reduced. An angle of 45° reduces the apparent speed to 70 per cent as compared to the speed when photographed at right angles, and image movement during exposure is reduced 30 per cent which often is sufficient to give satisfactory sharpness to pictures. When the angle





is further reduced to 30° the apparent speed is only 50 per cent of that at right angles. This angle is especially valuable when dealing with higher speed, for example with airplanes and racing cars.

Another method of stopping movement of such fast objects as racing cars is to swing the camera to hold the image of the object in the view finder while making the exposure. Thus in Fig. 2, the approaching car is caught in the view finder at position one and the camera is swung toward the right of the photographer. Exposure is made at position three, for which the camera was previously focused.

In most action involving people there are moments of delayed or "frozen action." By referring to Fig. 12 you will notice that least motion takes place at positions 2 and 5. These are the instants when the arms and legs

An object approaching the photographer has much less apparent speed than one passing at right angles, as illustrated in the three positions shown above

are fully extended and slowing to a stop preparatory to beginning the reverse action. Photographs made at such instants have only simple motion to deal with. In Fig. 4 the boxer was photographed at the instant his arm completed its swinging blow. The exposure caught the arm at the instant of impact, yet failed to stop the motion of one foot, which is slightly blurred. In Fig. 9 exposure was made during the



Here are two examples of pictures taken at moments of "frozen action." The one above was taken at the end of a leg and arm swing, while the one at the right caught the boy pausing slightly to toss the ball





10

slight pause just before tossing the ball, and in Fig. 11 the figure was caught in the natural pause after the shovel was emptied. Sports photographers often take advantage of frozen action. These moments occur in nearly all sports, golf, tennis, basketball, baseball, etc.

It also should be remembered that there is an unavoidable natural delay in operating a shutter, both on the part of the photographer's contracting muscles and on the part of the shutter mechanism. For this reason the actual impulse to trip the shutter should precede by a fraction of a second the moment when the exposure is actually wanted. Lack of such anticipation often causes the camera shutter to click too late.



11

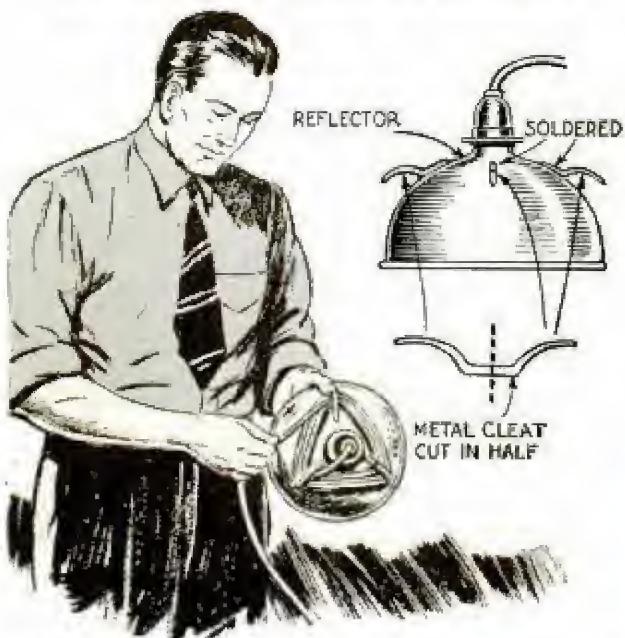
It's thrilling to captivate dynamic pictures like the fire-fighting scene or this study of a workman at a moment of retarded action

⑫ Shoot at moments of retarded action



MOMENTS OF "FROZEN MOTION" (LEAST MOTION) OCCUR AT NO. 2 AND NO. 5

Reflector Cord Wound on Cleats Does Not Tangle or Loosen



Since fitting my photoflood reflectors with cleats I have no trouble with loose and tangled light cords. Three cleats are spaced equally around the top of the reflector and the cord can be wound around

them quickly and easily and will remain in place. The cleats can be made by cutting a standard rope cleat in half.

—Robert Clark, Chicago.

Print Borders Masked with Tape Stay Clean during Coloring

Borders of tinted photographs will be neat and clean if they are covered with cellulose tape before you start the coloring and the tape will assure straight edges on the print. The tape can be removed easily when the job is finished.



A Streamlined Iceboat You Can Build

This 16-ft. skeeter-type ice yacht has a streamlined fuselage planked with $\frac{1}{2}$ -in. white pine. It carries 75 sq. ft. of sail and uses standard hardware. Our plans Nos. 1045 to 1048 inclusive, contain all necessary constructional details along with a material list, and will be sent postpaid upon receipt of \$1.00



Any six of these plans (not projects) will be sent postpaid upon receipt of \$1.00

Address—Plan Service, Popular Mechanics Magazine, 200 E. Ontario St., Chicago

Other Plans for Outdoor Winter Sport Devices

FRONT-STEERING ICEBOAT—786: Cockpit is 13 ft. long. Single sail of 75 sq. ft. on 18-ft. mast. 25c.

18-FT. ICEBOAT—774: Open cockpit seats four. Rear steering. Two sails. 25c.

AIR-PROPELLED ICEBOAT—785: Streamlined canvas-covered fuselage is 8 ft. long. Motorcycle engine drives a 52-in. prop. 25c.

SPEEDY BOBSLED—997: Box-type body gives rigidity and strength. Holds six passengers. Seat is 8 ft. 7 in. long. 25c.

COASTING TOBOGGAN—657: 6 $\frac{1}{2}$ ft. long by 16 in. wide. Print shows how to make form to bend bottom slats. 25c.

HOW TO MAKE SKIS—569: Print illustrates three types, 7 ft. long. Gives data on bending wood and ski sticks. 25c.

HOME-MADE SNOWSHOES—796 and 797: Prints show methods of steaming and bending frames, how to string rawhide cord, etc. Two prints 50c.



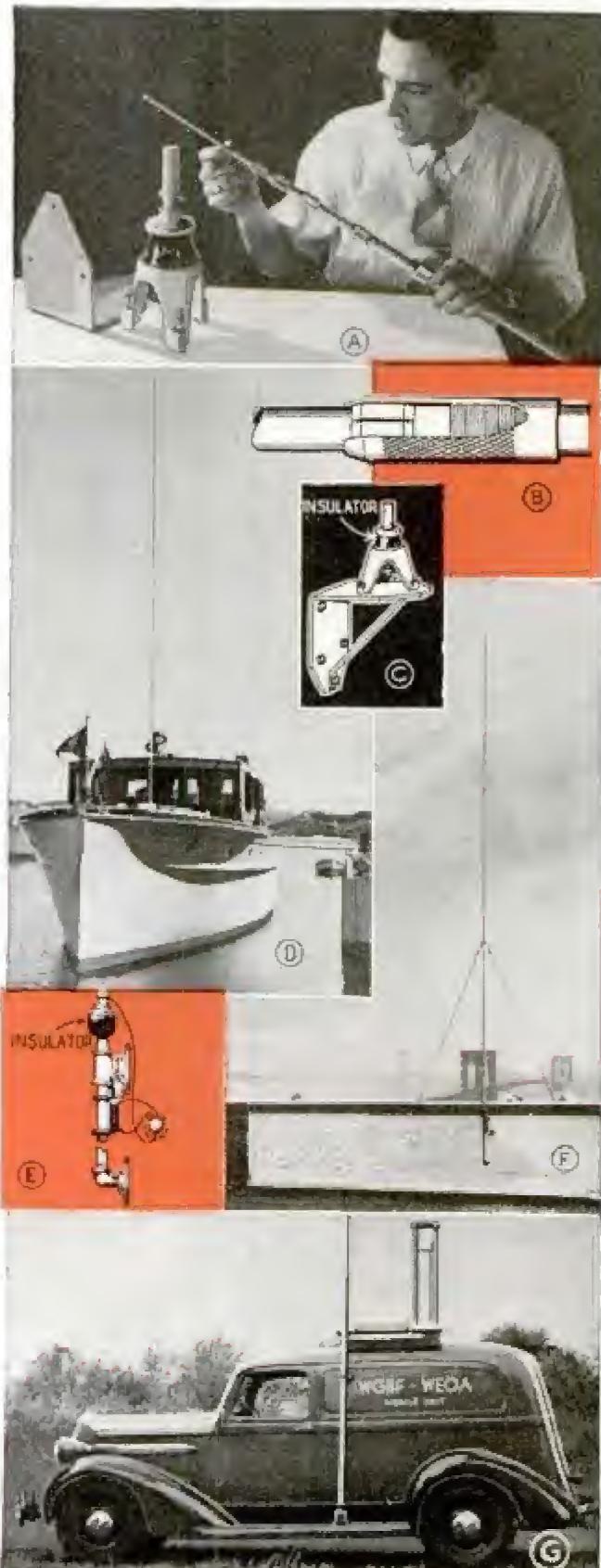
RADIO

Vertical Antenna Installations

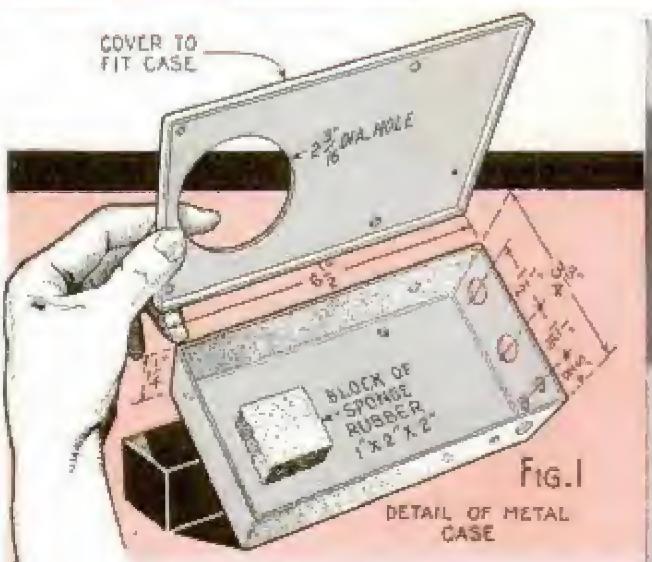
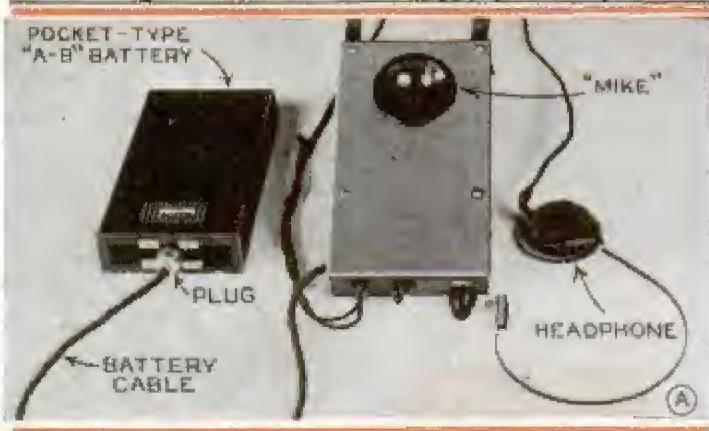
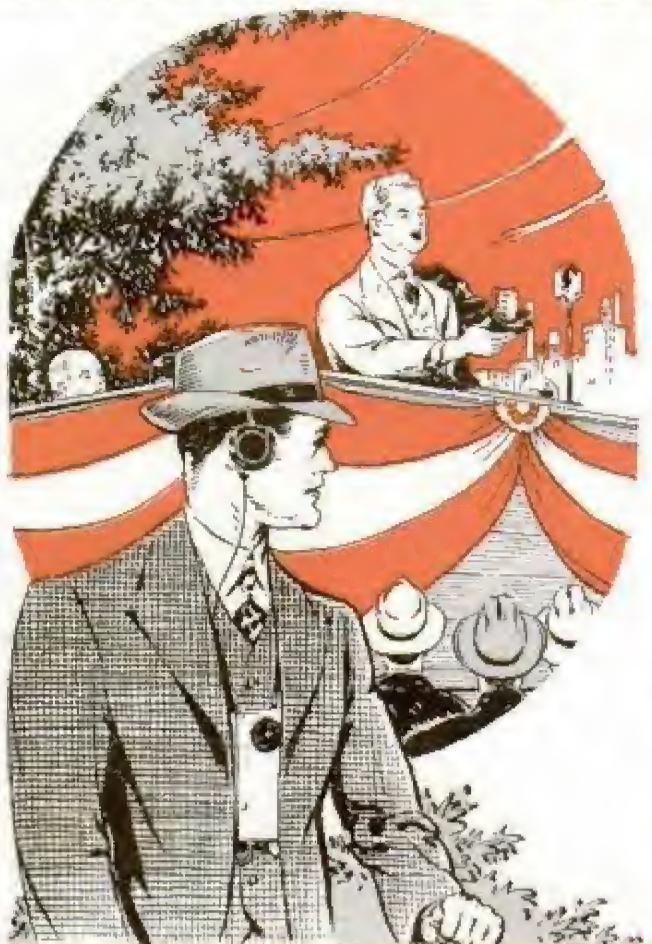
VERTICAL telescoping antenna systems, which receive and transmit equally well in all directions, are self-supporting and easily installed on roofs, boats and similar locations where sufficient room for a regular flat top installation is not available. Made of tubular steel, aluminum or Monel metal, all units are fully telescoping and adjustable between specified maximum and minimum lengths. Locking devices are provided at each joint.

Available in a variety of lengths up to about 35 ft., the antennas are provided with a heavy-duty footing or "Premax" base insulator of the same general construction as the large-footing insulators used on vertical towers of 800-ft. height. The Monel-metal variety shown in photo (A) is specially designed for marine installations where high strength and unusual resistance to corrosion are prime considerations; (B) is a sectional view of the locking clamp employed. A 25-ft. installation of this description is shown in photo (D). Wall bracket (C) is suggested for mounting the base insulator on side walls, or posts.

The parapet installation (F), with bracket assembly (E), is an aluminum vertical antenna for a multi-coupler receiving system which feeds up to 12 outlets installed in a large office building. Photo (G) shows a 34-ft. steel vertical on a mobile truck unit at Evansville, Ind. Tubular steel antennas of this type, suitable for home receiving systems, are heavily plated in bright cadmium to resist corrosion and are claimed to withstand high winds and all ordinary stresses in the services to which they are adapted. Guying, while not obligatory, is suggested as a reasonable precaution where possible, especially in localities where high winds are encountered frequently.



MINIATURE TUBES *in*



By L. M. Dezettel

ANY radio experimenter can build this compact and highly efficient wearable hearing-aid amplifier. Standard tiny radio tubes, with miniature sockets to match, are now available to experimenters and open up a new and interesting field for really portable homemade amplifiers and pocket-type receivers.

Smaller than the average person's little finger, these tubes, shown in photo (B), make possible the construction of a 3-tube amplifier for the hard of hearing that is compact enough to be worn on the person. The resistance-coupled amplifier circuit to be described employs three of these high-gain bantam pentodes and provides sufficient amplification to boost the output of the crystal-type microphone to several times the volume of a normal speaking voice. Housed in a small aluminum case of simple design, the completed instrument is light and compact enough to be worn suspended by means of a length of ribbon, or tape, around the neck, as shown in the photo and sketch. Power is supplied by means of a standard combination A and B-battery which fits the pocket. This battery unit is connected by a plug at the end of a short length of 3-conductor cable.

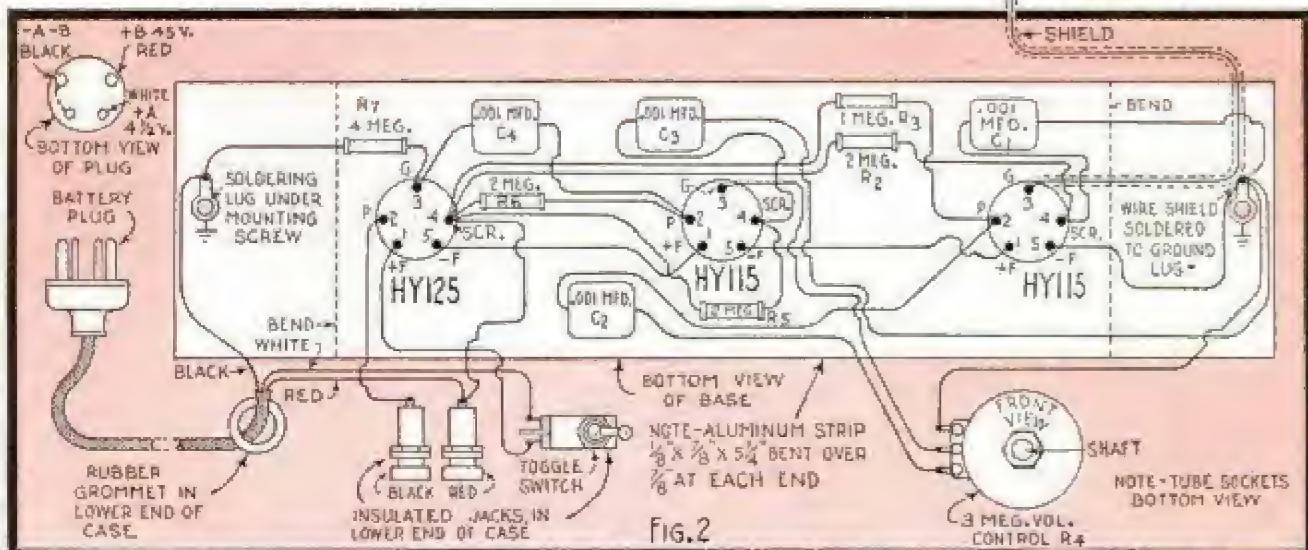
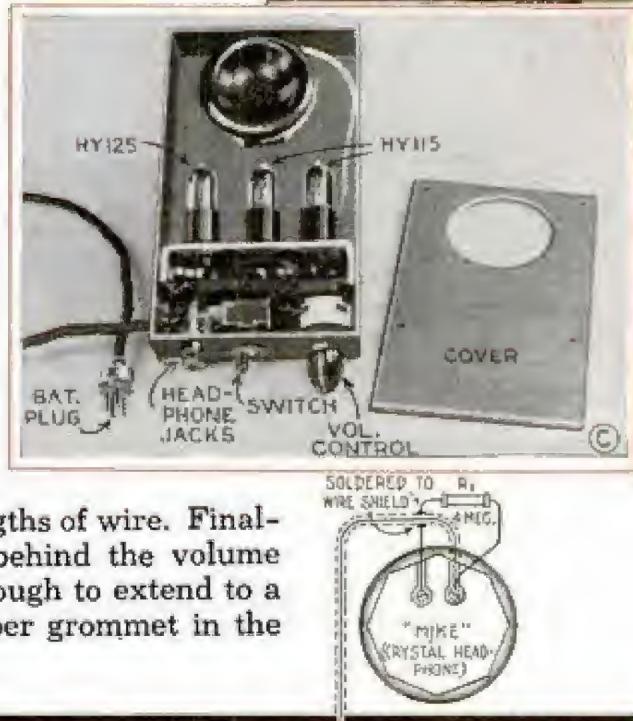
A single crystal earphone is used as a microphone for economy and good quality; it is held in place by the pressure of the front cover and a piece of 1-in. thick sponge rubber mounted as

WEARABLE HEARING AID

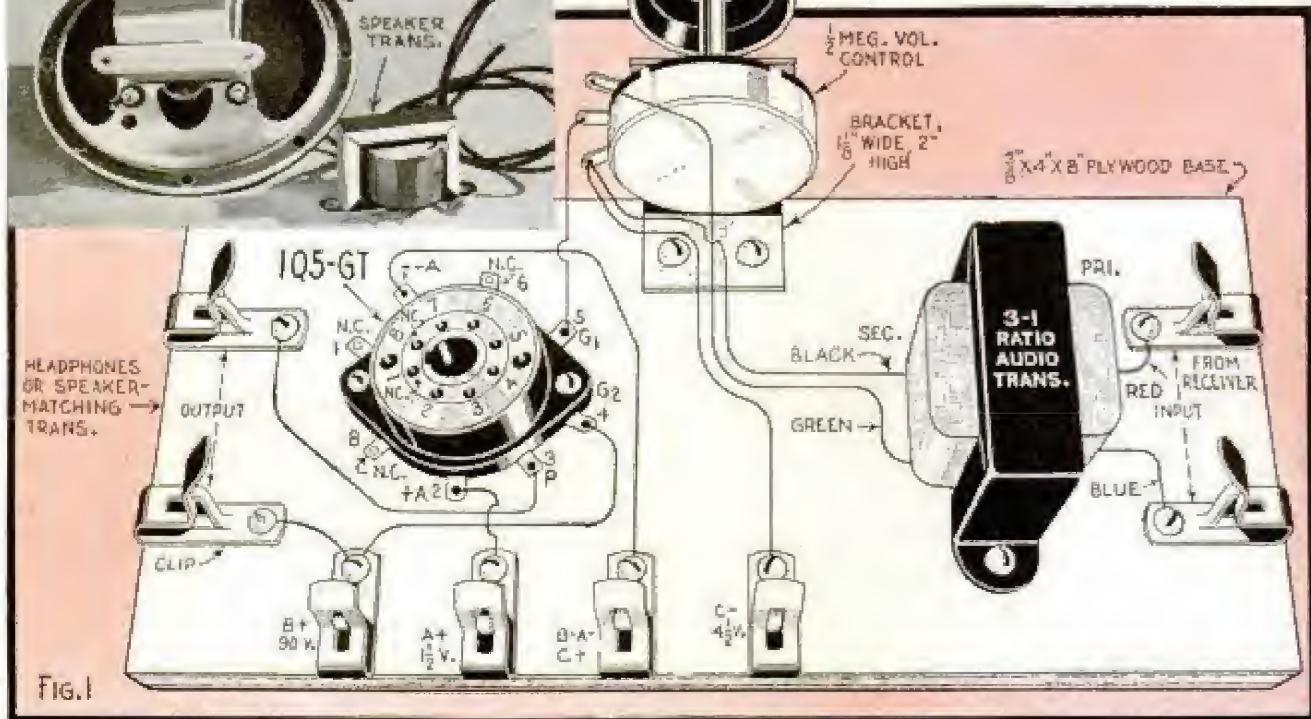
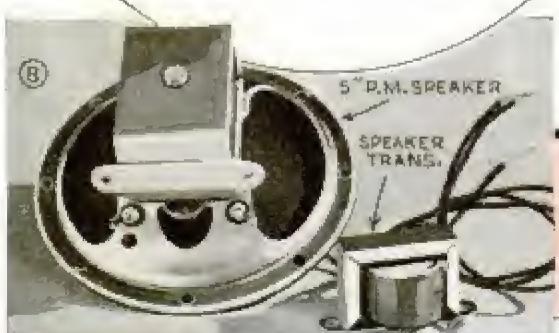
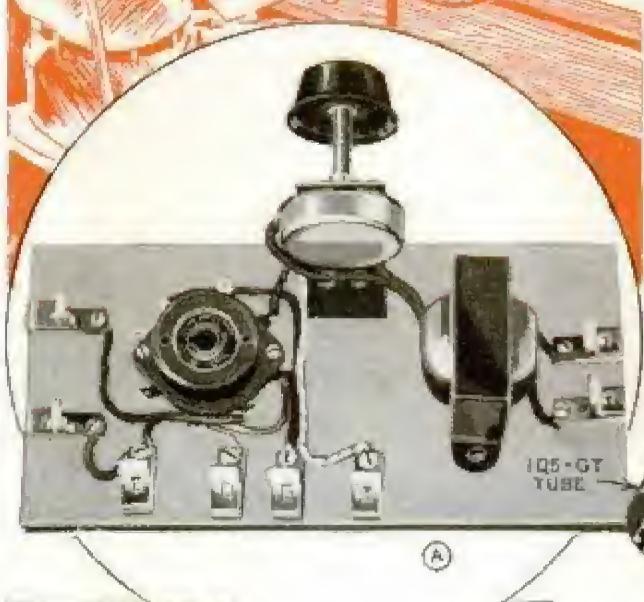
shown in Fig. 1. This detailed sketch gives all dimensions for the aluminum case, which, when completed, may be given a coat of the new air-drying gray crackle varnish for an attractive finish.

The various radio parts are mounted on an aluminum strip $\frac{1}{8}$ by $\frac{1}{8}$ by $5\frac{1}{4}$ in., bent over $\frac{1}{8}$ in. at each end as indicated in the simplified wiring diagram Fig. 2. This diagram shows an underside view of all parts and wiring including the leads to the volume control, switch and insulated phone-tip jacks mounted in the end of the case. Please note that a shielded lead is employed to connect the microphone to the amplifier. This woven-wire shield is soldered to ground on the metal strip, and also carefully soldered to the "mike" terminal and resistor (R_1) as shown. All wiring should be done on the small chassis base strip before it is fastened in the case by means of a short machine screw at each side. One-fourth watt resistors and small mica-type condensers are used throughout to save space. Wire all resistors and condensers except the coupling condenser (C_2) connecting to the volume control. Leave 3-inch leads for wiring to the parts mounted on the case after the chassis is bolted in. Make all leads as short and direct as possible by clipping off any excess lengths of wire. Finally wire in condenser (C_2) and tuck it in behind the volume control (R_4). The 3-wire cable, just long enough to extend to a convenient pocket, is passed through a rubber grommet in the

(Continued to page 130A)



One-Tube Battery Amplifier for Beginners



BUILD this battery-operated audio amplifier and use it to pep up the volume of any one-tube receiver. Designed at the request of experimenters and students who build and use one-tube short-wave and broadcast-band sets, this simple breadboard layout employs a type 1Q5-GT low-drain tube, 3 to 1 ratio audio transformer and a $\frac{1}{2}$ -megohm volume control. An inexpensive universal-type speaker-matching transformer is easily connected to the output clips so that a 5-in. permanent-magnet speaker may be used instead of earphones, if desired.

The amplification of this single audio stage is sufficient for use with a magnetic phonograph pick-up, and, for home entertainment a single-button carbon microphone may be employed to provide a miniature public-address system. When "mike" input is used, it is necessary to substitute a microphone transformer for the 3-1 audio transformer. Connect an additional 4½-volt C-battery in series with one side of the mike, the positive side being connected directly to the microphone.

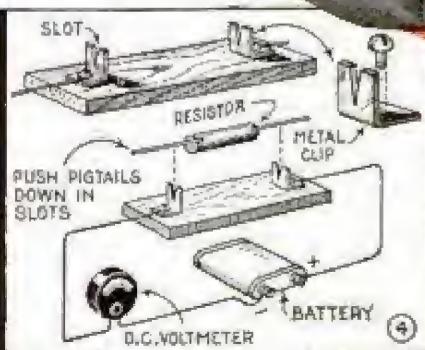
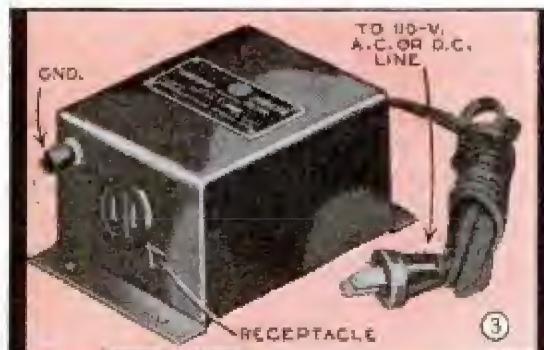
A simplified wiring diagram is given in Fig. 1; this shows a top view of the tube socket and all connections clearly. The schematic circuit diagram is shown in Fig. 2; this diagram also shows the battery connections. It will be noted that the A-battery supply is ob-

(Continued to page 132A)

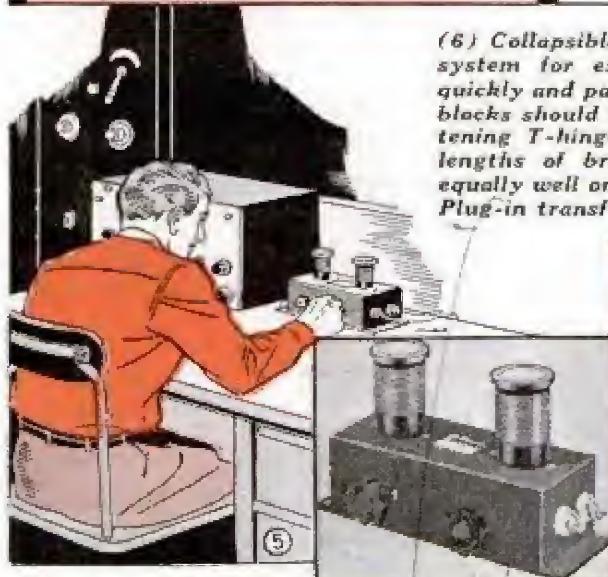
RADIO HINTS



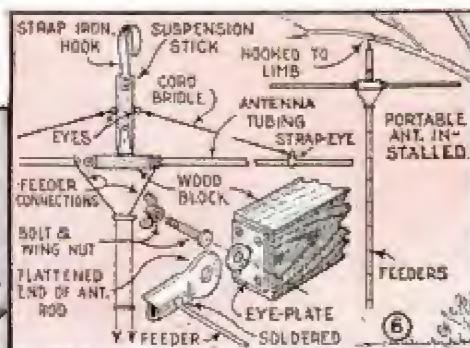
(1) Bicycle riders can now enjoy radio programs as they pedal along streets and country roads. Serving the owner in practically the same manner that an auto radio does a car, this "bike" set employs 3 tubes—two triple-purpose and one power tube. Batteries are housed in compact case easily mounted to frame; receiver comes complete with built-in 4-in. P.M. speaker, antenna, batteries and accessories for mounting. (2) Radio chemical kit in leatherette pocket case, contains service cement, carbon-x, grapholine, scratch polish, contact cleaner and similar materials. (3) Universal radio noise filter for use with any 110-volt a.c.-or d.c. line



(4) Homemade resistance checker gives approximate reading where value is in doubt. By checking 5-volt voltmeter with several known values of resistance, at the same 4½-v. battery voltage, scale readings can be obtained for each value. (5) Inexpensive unit makes accurate impedance match between any type antenna and receiver for high signal gain, without tubes



(6) Collapsible ultra-high-frequency antenna system for experimenters; can be erected quickly and packs away in small space. Wood blocks should be boiled in paraffin before fastening T-hinge and eye plates. Two 4-ft. lengths of brass or copper tubing operate equally well on 56,112 or 224 megacycles. (7) Plug-in transformer for use in limited space

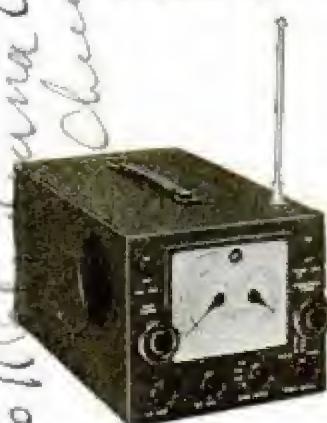


*Radio Facsimile News Printer
Works at High Speed*



Printing the outstanding news of the day in condensed form, this home-type receiver-recorder demonstrated at the New York World's Fair prints a miniature front page, 8½ by 12 in. per sheet, every ten minutes. This is more than twice as fast as it could be done a year ago, when similar experimental radio facsimile apparatus was exhibited.

Portable All-Wave Receiver



Combining the convenience features of the modern 3-in-1 portable with those of a good amateur-band receiver, this 9-tube set operates from any 110-volt a.c. or d.c. line or from batteries. One set of bat-

833 W. Jackson
teries provides approximately 100 hours of service. Tuning range is continuous from 542 kc. to 30.5 megacycles.

Universal 20-Watt Amplifier

Completely self-contained in one compact case, this 20-watt amplifier may be used with any high-impedance type microphone. A built-in phono turntable adds to the operating convenience; the unit operates from 110-v. line or 6-volt battery.



Armchair Radio-Phonograph

This 8-tube chair-side receiver covers the broadcast and foreign short-wave bands, employs a 12-in. speaker and has a built-in automatic record changer. It is also available in similar combination with single record-playing mechanism.



Blueprints covering radio construction articles in this and past issues are available for 25 cents each. Original material lists, with names of manufacturers and dealers, can be obtained from our Radio Department upon receipt of postage.

NEXT MONTH—How to Build a Two-Tube A.C.-D.C. Receiver and Phono Amplifier. Here is an easy-to-build low-cost broadcast set with dual-purpose tubes, built-in speaker and provision made for using the audio section to amplify the output of any inexpensive record player of the motor-driven turntable type



SHOP NOTES

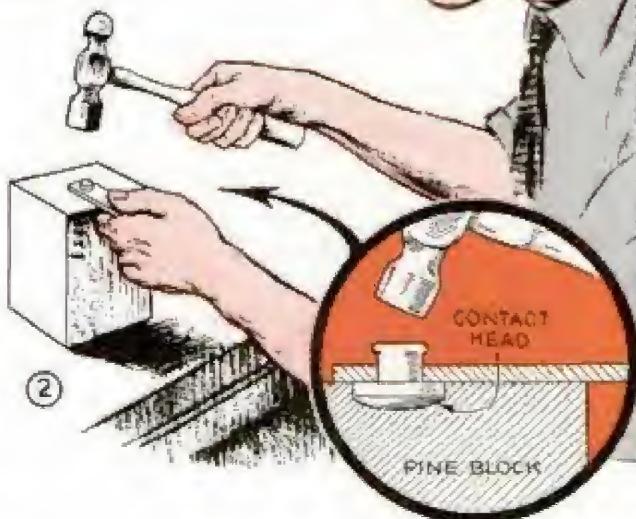
Making GOOD CONTACTS

*How to select and install
silver or tungsten contacts
on operating electrical devices*

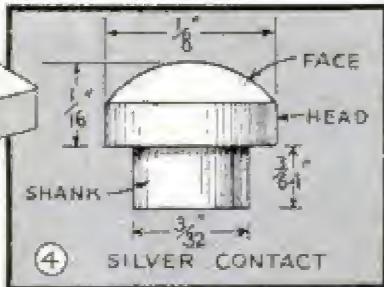
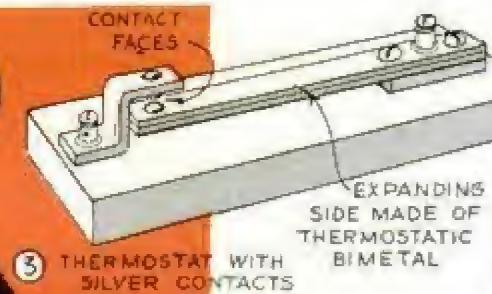
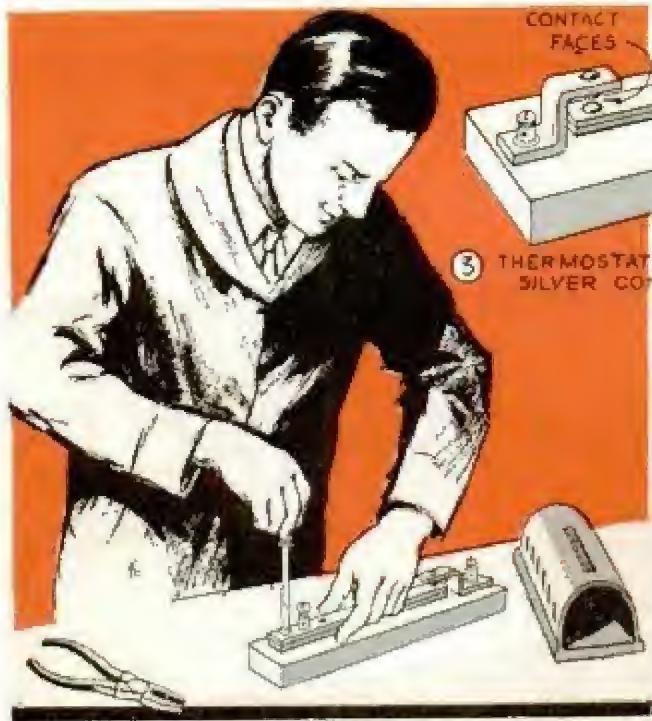


By C. A. CROWLEY

AS THE satisfactory operation of many electrical appliances and devices depends on the flow of electricity across a pair of closed movable contacts, as in thermostats, relays, etc., Fig. 1, it is important that they be kept clean, and that the proper type be used for the particular job. No matter what type or style contacts are used they get dirty or pitted and require occasional cleaning. Emery paper or cloth should not be used to clean contacts. Fuzz or grit is liable to be left between the faces, leaving the contacts little better, or even worse, than before. Carefully drawing a thin, flat file between the faces will remove the scale and pits. The filings and accumulated greasy dirt should be wiped off with a piece of chamois moistened in cleaning fluid. The capacity of condensers across a pair of contacts, when this method is used to prevent sparking on d.c. circuits, should not be so high as to eliminate the spark altogether. A little sparking burns away



the accumulations of greasy dirt resulting in better performance. Where contacts carry a heavy load, a resistance coil of about 1 ohm per volt in the circuit should be connected in series with the condenser to prevent the contacts from overheating during the break or when they chatter slightly as often may be the case. Although many metals and alloys are used, contacts of silver or tungsten are best usually.

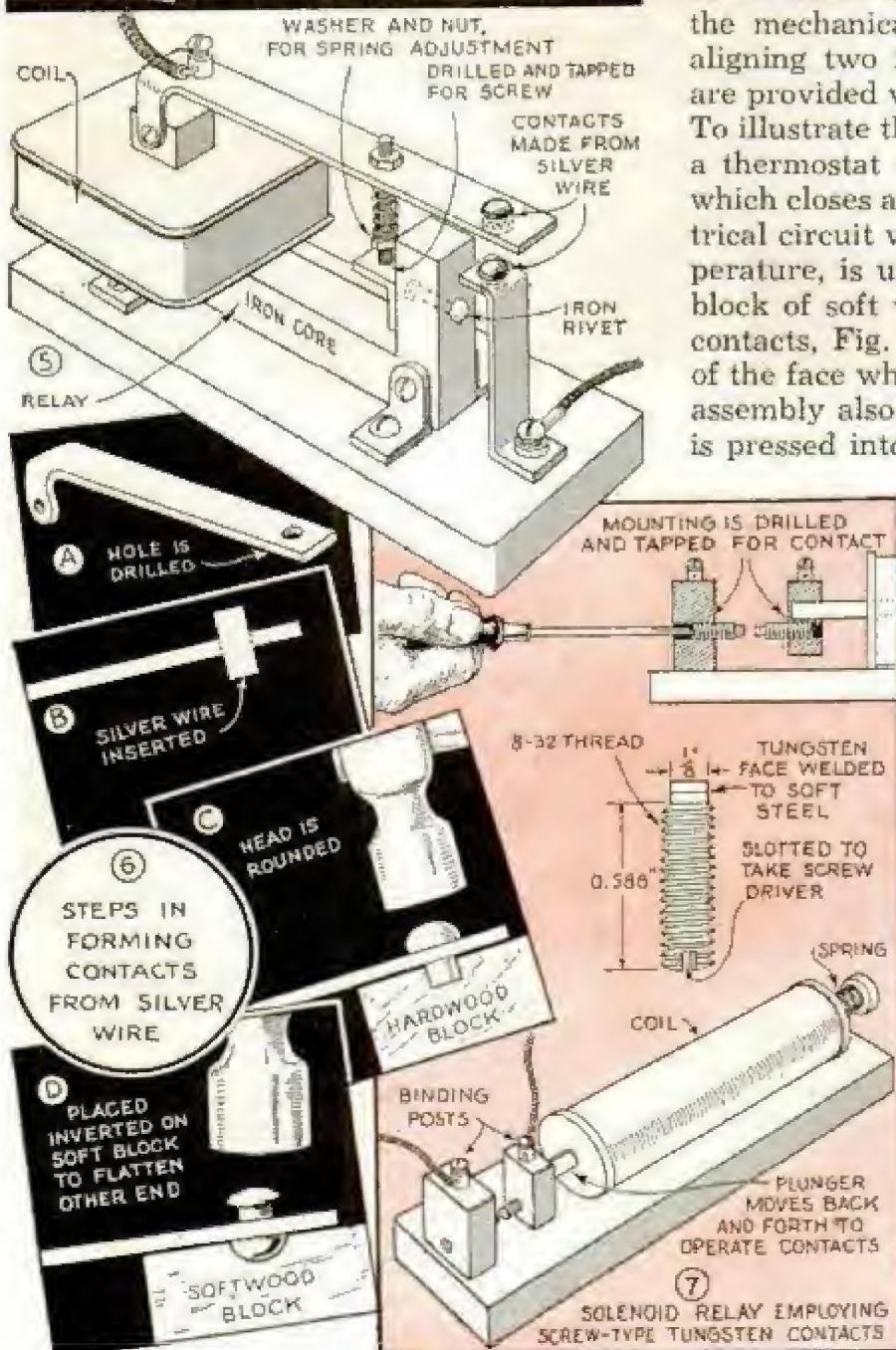


Silver contacts: Pure silver has the lowest electrical resistance of any metal, and makes the best contacts where the voltage and the mechanical pressure holding the contacts together are both low. Relays, thermostats and other devices operating with a voltage not greater than 6 volts, perform better if the contacts are of silver.

Silver rivet contacts: Silver contacts are made in the form of rivets for convenience, as the metal is soft and malleable. Due to the mechanical impossibility of perfectly aligning two flat surfaces, silver contacts are provided with radius faces as in Fig. 4. To illustrate the use of this type of contact, a thermostat of the type shown in Fig. 3 which closes and opens a low-voltage electrical circuit with a rise or fall in air temperature, is used as an example. Using a block of soft white pine as a base for the contacts, Fig. 2, will prevent deformation of the face when mounting. The mounting assembly also shows how the contact face is pressed into the soft wood by the force of the hammer blows in heading over the shank. In those cases where a vise must be used to press-fit the contacts into a mounting thicker than the length of the contact shank, the soft pine block will protect the head from deformation by the jaws.

Silver wire contact points: Contacts for small assemblies like the relay shown in Fig. 5 can be made easily from silver wire and formed right on the mounting. Fig. 6 illustrates the method used, which is nothing more than forming the head or face of the contact with a hammer.

Tungsten contacts: In building large relays, automatic switches, buzzers,



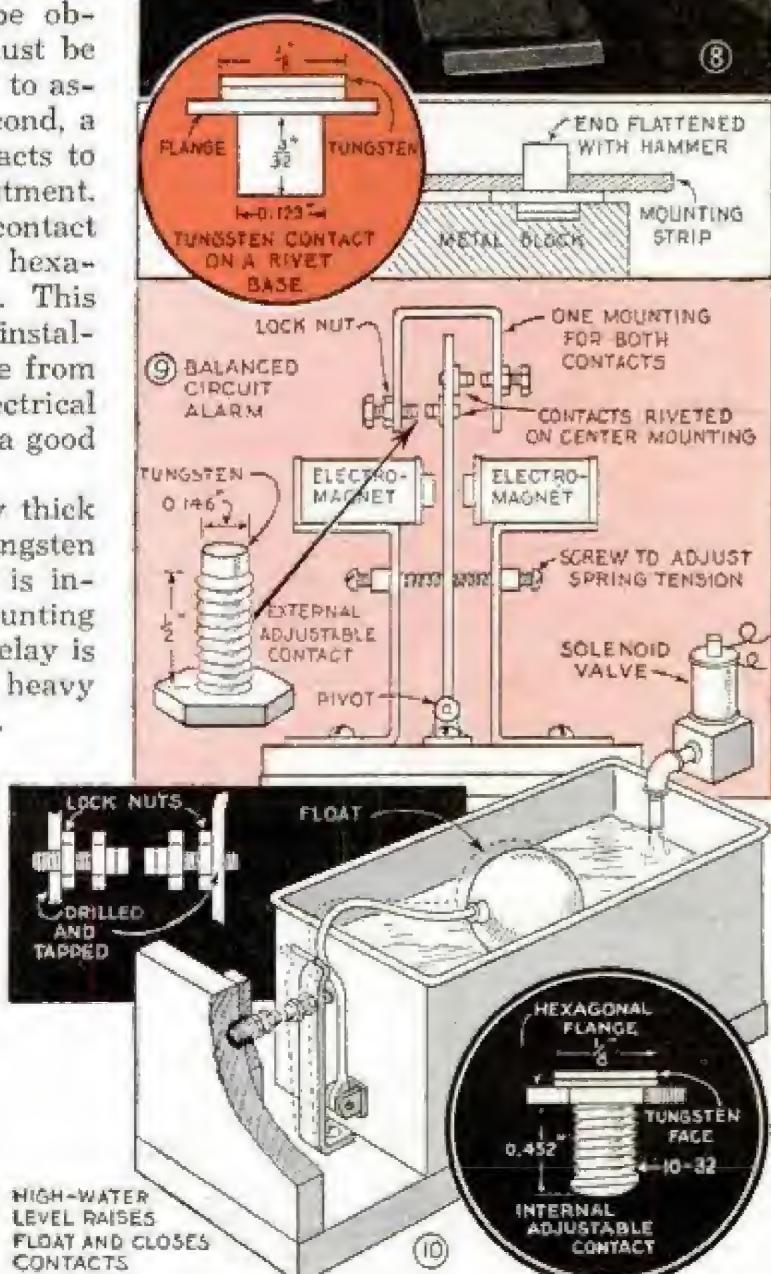
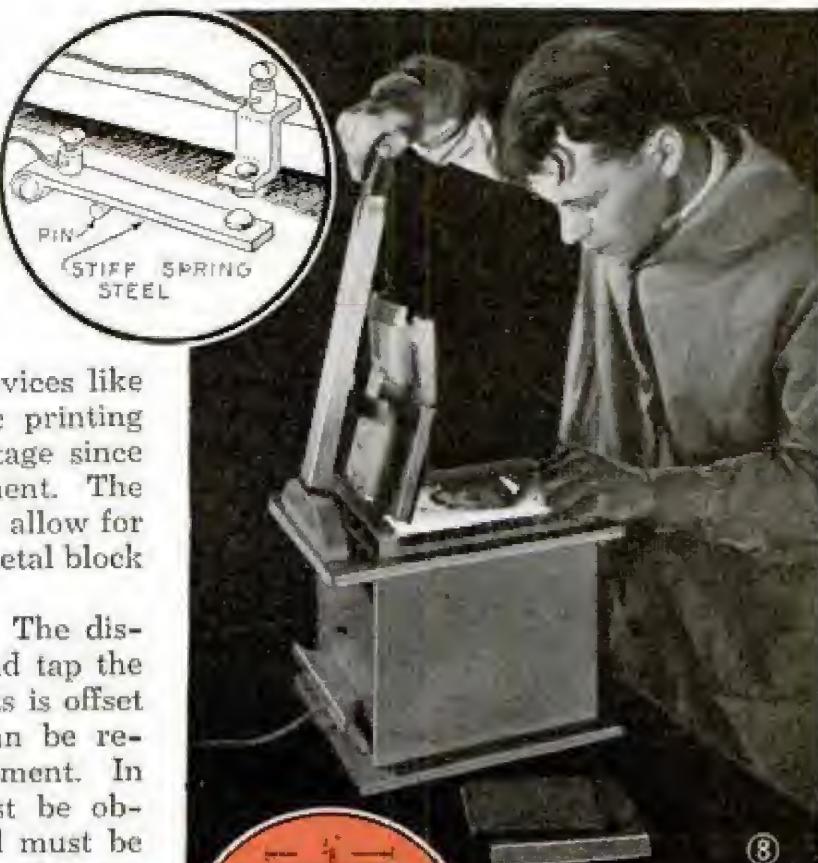
and similar devices with voltages ranging from 6 to 135 volts, it is best to use tungsten contacts. Tungsten is very hard, so contacts of this metal are always furnished welded to a soft steel base screw or rivet.

Tungsten rivet contacts: Rivet contacts like the one shown in the circular detail of Fig. 8 are the easiest to install. On devices like the switch on the photographic printing box they can be used to advantage since they need little or no adjustment. The flange on tungsten rivet contacts allow for a firm support of the head on a metal block when mounting them.

Internal adjustment contacts: The disadvantages of having to drill and tap the mounting for screw-type contacts is offset by their adjustability. They can be removed for cleaning or replacement. In mounting, two precautions must be observed. First, the tap drill used must be exactly the right size for the thread to assure a tight fit to the contacts. Second, a lock nut must be used on the contacts to tighten them in place after adjustment. The internal adjustment-screw contact shown in Fig. 10 is provided with a hexagonal flange just back of the face. This type of screw contact is used where installation and adjustment must be done from between the two mountings. The electrical overflow control for water tanks is a good example of this.

Headless contact: Useful on very thick mountings is the headless, slotted, tungsten contact screw shown in Fig. 7. It is installed from the outside of the mounting with a screwdriver. The solenoid relay is just one example of a device using heavy mountings with this type of contact.

External adjusting contact: On some devices adjustment and installation of the contacts can only be accomplished from the outside of the mountings. In Fig. 9 is shown a tungsten screw-contact unit designed to meet these conditions. The hexagonal adjustment head is on the end opposite the face. Two of these contacts, installed with lock nuts from the outside on the stationary mounting of the alarm control, oppose two rivet-type contacts installed on the movable mounting.

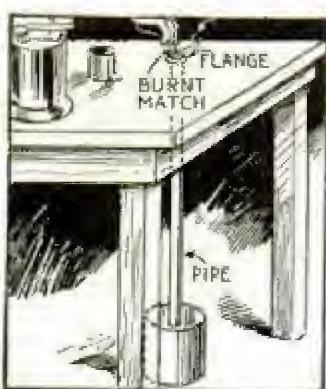


Oilcloth Having Block Pattern Aids in Cutting Glass



A hardware dealer who had much glass cutting to do in his store improvised a glass-cutting chart that saved him considerable time and labor in this work. The chart consists of a strip of oilcloth, the pattern of which is of 1-in. blocks or squares. By placing the pane of glass upon the lines and measuring off the number of inches to be cut from the sheet, the rule may be placed upon the line and the work accomplished in a jiffy. For greater convenience, the chart is attached to a window-shade roller, which is mounted at one end of the counter, and the chart is thereby rolled up out of the way when not in use. If desired, and oilcloth of this pattern cannot be obtained easily, the chart may be ruled with pencil upon any cloth window shade, but the oilcloth will prove more lasting and serviceable as it will resist the wear, and glass will not slip easily.

Receptacle Built in Workbench Extinguishes Lighted Matches



To avoid fires being started by matches thrown about his shop, after lighting gas burners and torches, one tinsmith installed this receptacle. It consists of a length of pipe run through

the bench top to end in a pail or can underneath the bench. A flange at the upper end of the pipe holds it in place. The lower end of the pipe must rest on the bottom of the pail. Matches dropped into the pipe are instantly extinguished, and when filled, the pipe is lifted to deposit the matches in the pail for disposal.

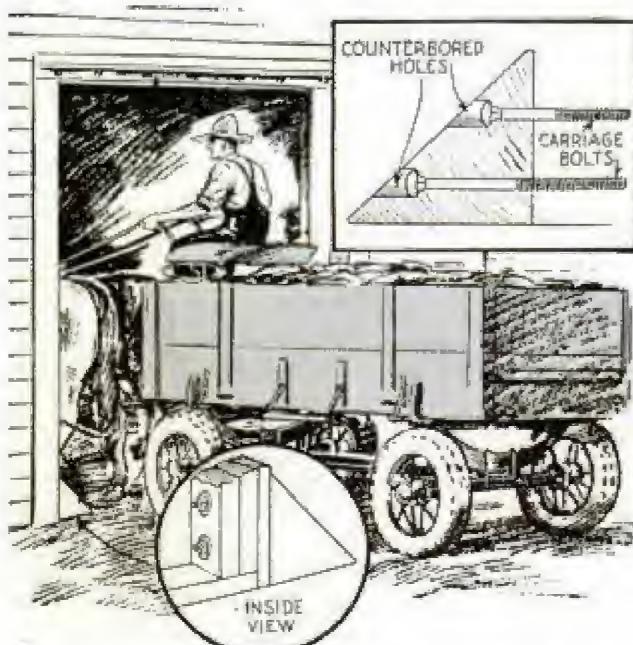
Pen Point Is Miniature Scoop for Weighing Chemicals

In handling minute quantities of various chemicals, a chemist finds that his work is made easier by using the end of a pen point as a scoop. The pen is inserted point foremost into a penholder, which serves as a handle. The scoop makes it possible to drop one crystal or grain of a chemical at a time into the scale.



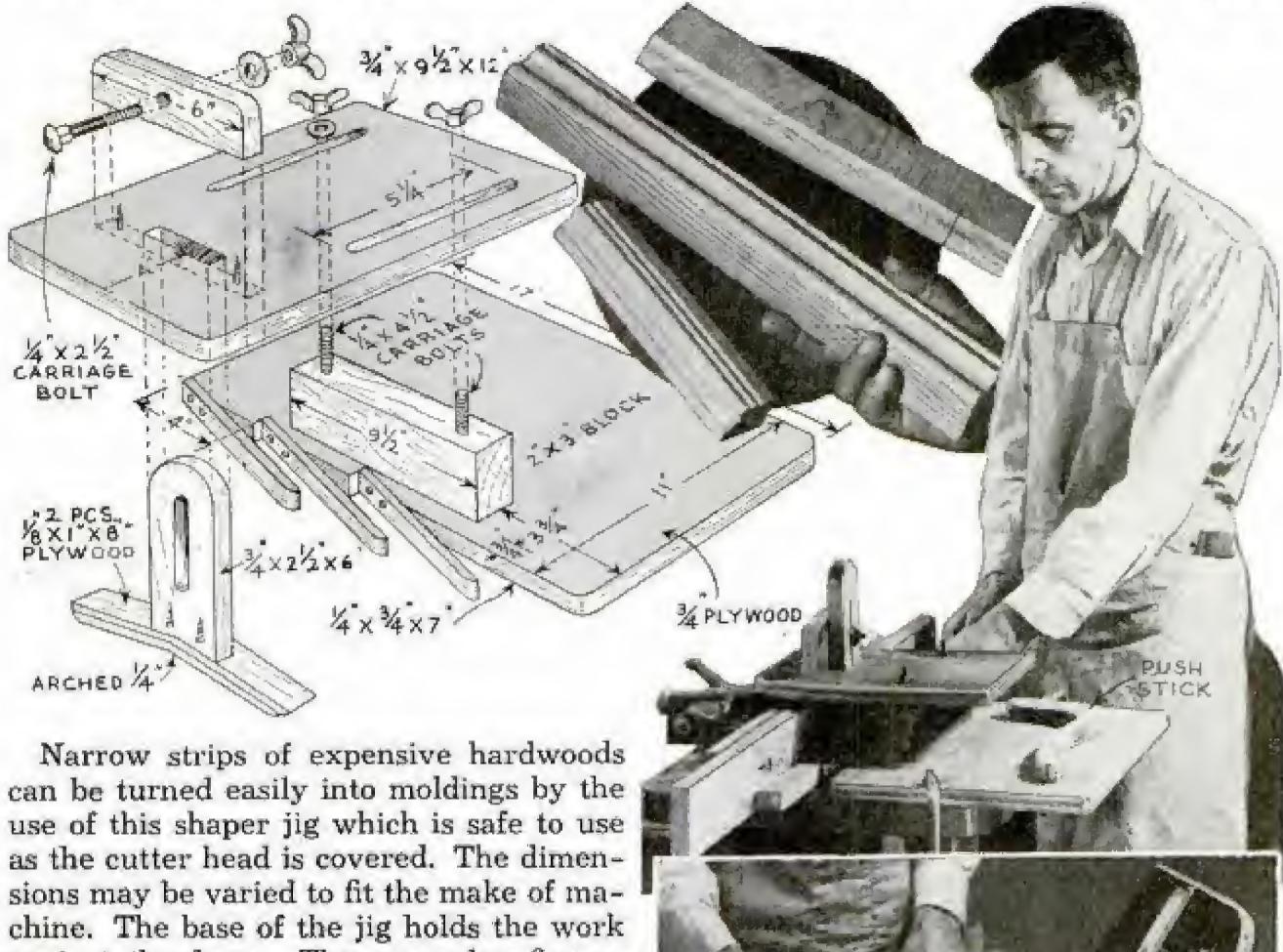
Wood Blocks Protect Door Frame When Entering with Wagon

One farmer has large blocks bolted to the lower corners of all door frames through which wagons or other wheeled implements are driven as a protection for the frames. The blocks slope from the top



toward the bottom so that a wheel of a wagon entering is kept far enough away from the frame to prevent the tire or hub touching it. The blocks are attached to the frames with long, countersunk bolts.

Strip Moldings Cut Safely with this Shaper Jig



Narrow strips of expensive hardwoods can be turned easily into moldings by the use of this shaper jig which is safe to use as the cutter head is covered. The dimensions may be varied to fit the make of machine. The base of the jig holds the work against the fence. Three wooden fingers press the strip against the cutter and allow for slight irregularities in width. It can be held in any position by means of two C-clamps, and takes stock up to 5 in. in width. The heavy cleat, which supports the jig top, is of such height that the top clears the fence. The top has slots to receive the cleat bolts and to make adjustments. A rectangular hole takes the slotted hold-down slide, and a cleat behind it locks the slide by means of a bolt and wing nut. The wooden spring on the hold-down, added to give positive pressure against the table, is made of two thicknesses of $\frac{1}{8}$ -in. three-ply hardwood, curved up into the slide arch with two screws. To use the jig, loosen the



three clamp bolts and adjust the base with the fingers $\frac{1}{16}$ in. less than the strip width, from the fence. Set the top with the hold-down near the fence, and clamp. Then lock the hold-down. Feed the stock from right to left, and if it is not long enough to grasp easily on the far end, for pulling through in finishing the cut, use a long push stick.

Length of Endless Belt Measured Accurately by Rolling It on the Floor

One of the best methods of measuring an endless belt to find its length is as follows: Place the belt on a floor or other smooth surface. Then mark both the belt and floor.

Roll the belt across the floor as indicated by A*1, A*2 and A*3 until the mark comes to the

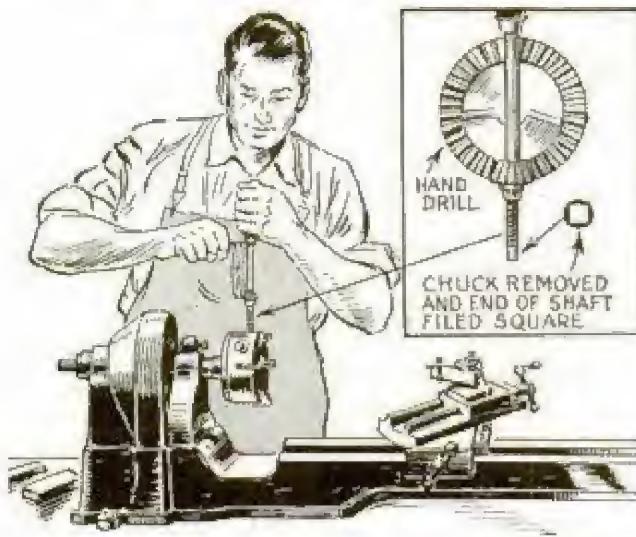
floor again, taking care that there is no slip between the belt and floor as it is rolled. The distance between A*1 and A*3 will be the exact length of the belt.

—W. F. Schaphorst, Newark, N. J.

CKeep a three-minute egg timer near the phone to check long-distance calls; invert it as soon as the connection is made.



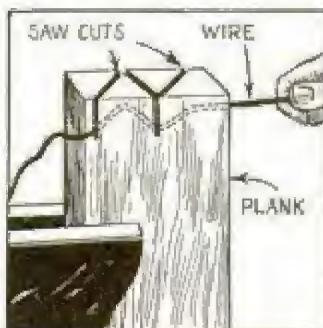
Speed Chuck Wrench Saves Time for Lathe Operators



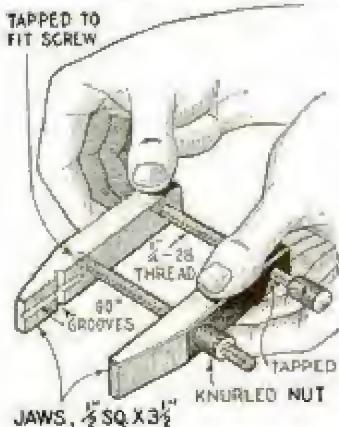
If you occasionally have a lathe job that requires resetting chucks frequently for small work, this simple speed wrench will save considerable time. It is nothing more than an ordinary hand drill with the chuck removed and the end of the shaft squared to fit the chuck screws.

Small Wire Straightened Quickly in Slotted Plank

Wishing to save wire removed from hay bales for future use, a farmer straightened it by pulling it through slots cut in the end of a hardwood plank as shown. The plank was clamped in a bench vise and the wire slipped into the slots from the top.



Improving Parallel Clamps

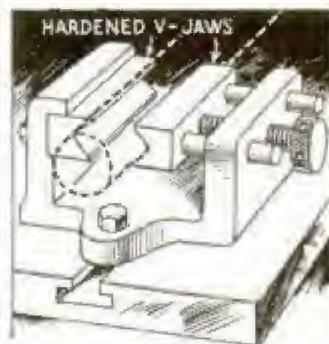


I have made several pairs of parallel clamps that I consider an improvement over the conventional type. They are similar to the usual type, and of approximately the same dimensions except that

both screws extend from the same jaw. This permits the clamps to rest flatly on the one jaw when used on a drill-press table or other plane surface. The slight V-grooves cut into the lower jaw enable one to hold small pins or parts while drilling, filing or grinding them. The forward hole in the upper jaw is drilled slightly oversize. This allows a little play in the jaw, which permits one to hold work of uneven thickness or tapered parts without slipping.—H. J. Field, Haydenville, Mass.

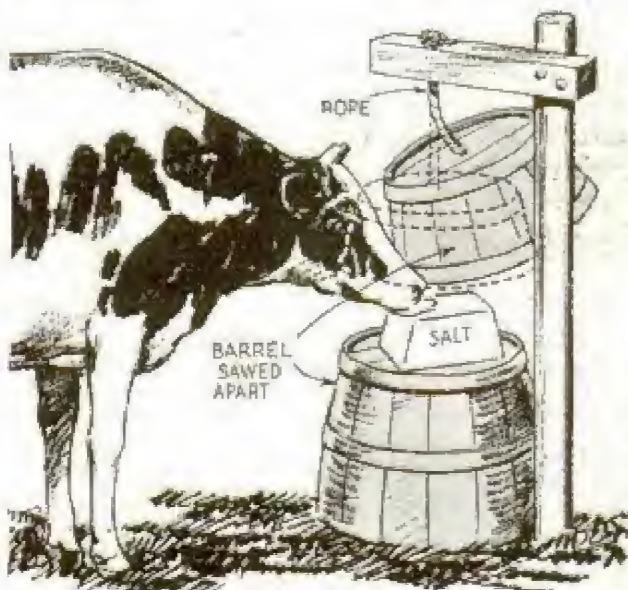
V-Jaw Vise to Grip Round Work

Where shafts or other round work are to be drilled or machined, a vise with V-jaws like this one will be very handy. It isn't much of a job to make it from cold-rolled steel, and it can be used on any machine having a T-slot in the table in which it is fastened.



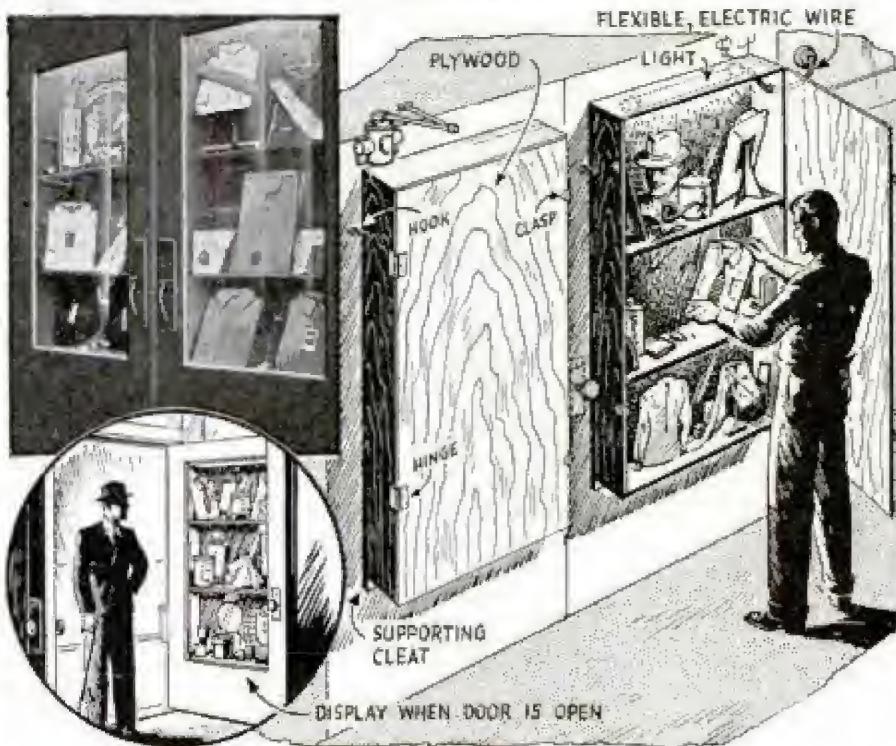
Salt Dispenser Has Cover to Keep Out Rain

To keep rock salt handy for his cattle in the pasture, and yet protected from rain, one farmer sawed the top section from a barrel, inverted the remaining section to serve as a table and suspended the smaller one over it. The hanging cover protects the salt block but is easily pushed aside by the cattle.



Entrance Doors Utilized as Display Windows

Confronted with the problem of limited show-window space, a merchant used the store doors to increase the space for his merchandise displays. Shallow cases or frames fitted with shelves and hinged backs were hung behind the glass in the doors and supported by means of three strong hooks of the screen-door type. The cases rest on $\frac{3}{4}$ -in. wood cleats screwed into the door near the base. This made it easy to remove the cases when desired, and the hinged backs made it easy to change or rearrange the displays. The number of shelves is optional and the interior can be illuminated with a hidden lamp mounted at the top of each case. Throughout the day when the store doors are opened and swung back inside, the case acts as an in-



terior display, while at night when the doors are closed the cases are illuminated by merely plugging in the lamps to a convenient wall outlet.

—K. F. Keith, St. Petersburg, Fla.

Swinging Floodgate in Fence Not Easily Washed Away

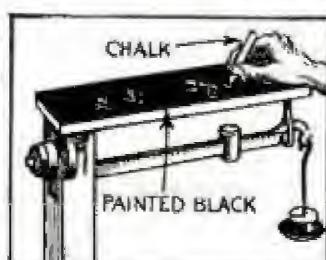
One of the simplest floodgates that will swing and allow debris to flow under it and return to its normal position as the water recedes can be made as shown by



the photo. A length of large-diameter pipe is firmly attached at the proper height to posts on the banks of the stream, and from this the gate is suspended by means of U-bolts. The gate was made in a V-shape to conform to the slope of the stream banks. A heavy stake, pipe or other limiting device set firmly in the stream bed prevents opening of the guard in the wrong direction.—Elton Sterrett, Longview, Tex.

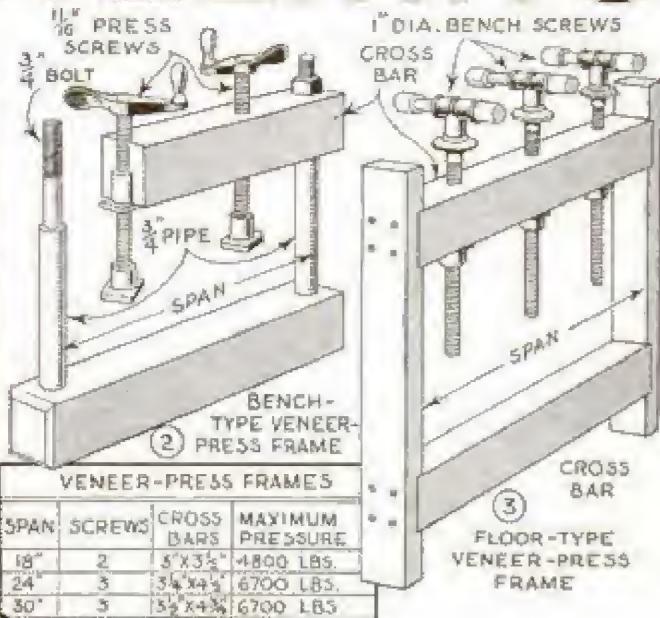
Blackboard Top on Store Scales Provides Surface for Figuring

Unable to keep scratch pads or tablets conveniently at hand for figuring weights, a merchant painted the top of his platform scales with blackboard paint. This provided a surface on which chalk could be used, and could be erased easily for repeated use.

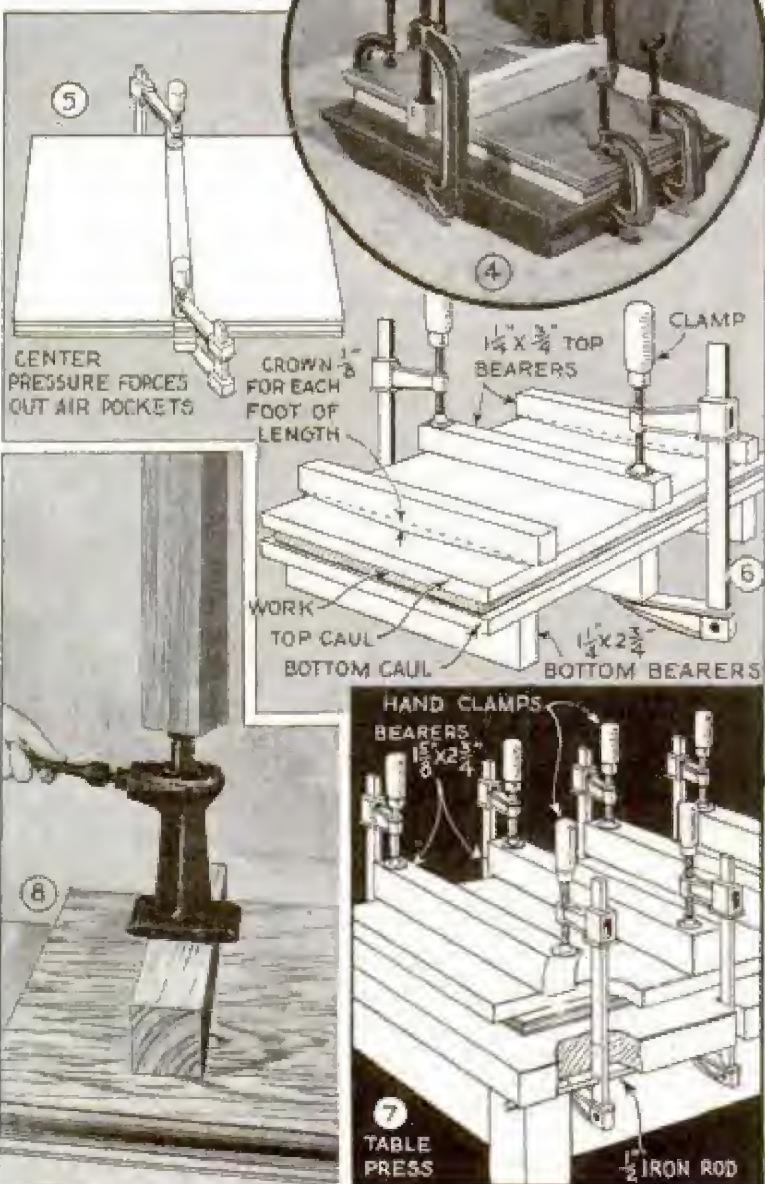




VENEERING



Methods of clamping

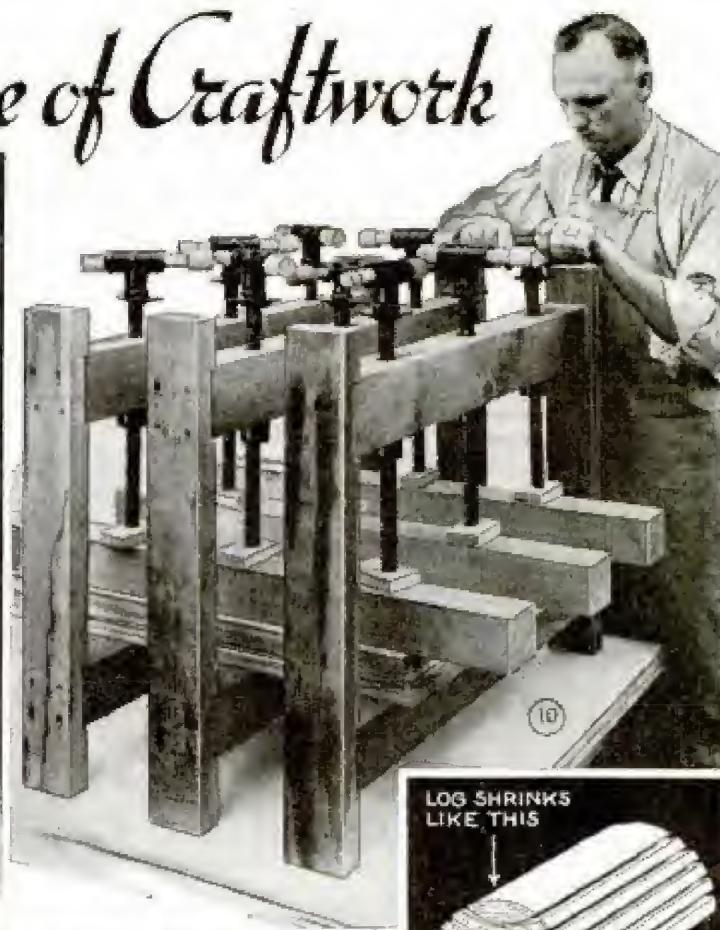
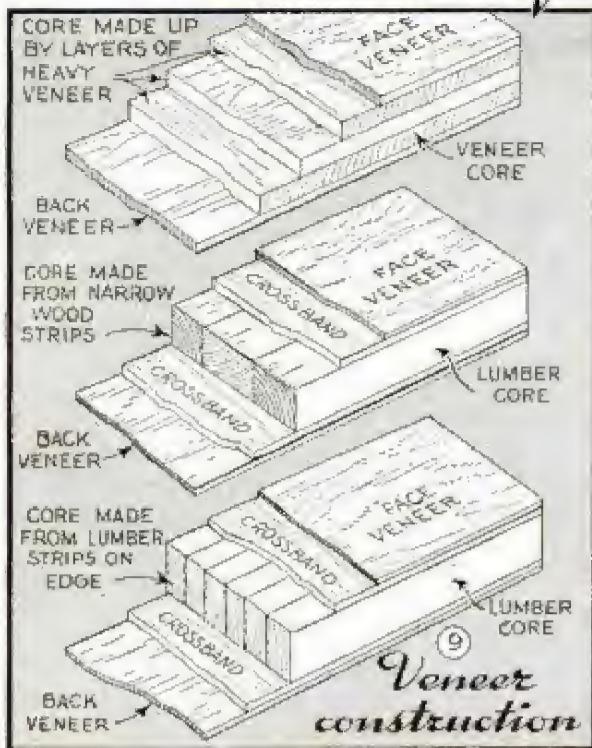


PART I

WHILE factory-made plywood is glued under pressures as much as 100 lbs. per sq. in., satisfactory work in the small shop can be done with a pressure of 20 lbs. per sq. in., which equals a weight of six tons on a 20 by 30-in. panel. Either hand clamps or press screws can be used. In Fig. 1 the work is held between $\frac{3}{4}$ -in. plywood boards or cauls and pressure is applied by means of bearers and clamps. Hand clamps of any kind can be figured at 800 lbs. each while press screws can be figured at 1,600 lbs. A safe rule to follow is to use one hand clamp for each 40 sq. in. of surface, and one press screw for each 80 sq. in. of surface.

Construction of veneer-press frames is given in the drawings, while the table shows the required dimensions of the cross bars to resist a given pressure. The wood used should be maple or yellow pine. Where a greater span is desired, the cross bars can be stiffened with iron plates. Fig. 2 shows a two-screw bench frame, while Fig. 3 shows a press of sufficient depth to be used on the floor, several of which are being used as a unit in Fig. 10. Fig. 4 shows how a surface plate or machine-table

Increases Scope of Craftwork



top can be used as a base for clamping. The standard set-up for clamping with bearers is given in Fig. 6. Note that the top bearers are not straight but are slightly curved on the underside. How the bearer method of clamping is used in making a permanent table press is given in Fig. 7. Excellent work can be done by using an automobile jack, Fig. 8, pushing against a heavy ceiling joist. After applying pressure in the center, the edges of the work are held by means of hand clamps. In any method of clamping, center pressure must be applied first, Fig. 5. This forces air pockets and excess glue to the edges of the work.

Veneer construction: Three of the commonest methods of constructing veneer panels are shown in Fig. 9. All are known as plywood. The center portion of the panel is the core. Lumber core plywood has a core of solid lumber strips. These are covered by a veneer called the crossband, and the crossbands are then faced with the face and back veneers. In all forms of construction, the grain of each layer is at right angles to the grain of the layer under it.

Making a lumber core: Plywood with either a veneer or lumber core can be purchased and needs only the application of face and back veneers to complete it. If the worker should wish to make his own core, the principles of core construction are illustrated in Figs. 11 to 14. Fig. 11 shows how lumber shrinks—always bowing out on the heart side. As a sheet of veneer has a tendency to pull the work hollow, it follows that where one face only of the core is to be veneered, the veneer should be applied on the heart side. This side is distinguished readily by inspecting the end grain, Fig. 12. To further eliminate warping, the lumber is usually ripped into narrow strips 3 to 4 in. wide, reversing every other piece end for end so that the heart side is alternately up and down, Fig. 13. Lumber cores always should be cross-banded, the best lumber for both cores and crossbands





Assembling a panel

being poplar. Veneer cores need not be cross-banded as the top layer of veneer is itself a cross-band. Face veneers should be applied with the right side out whenever possible. The right or "tight" side can be determined by rubbing the surface of the veneer with the fingers, as in Fig. 15, the right side having a slightly smoother grain.

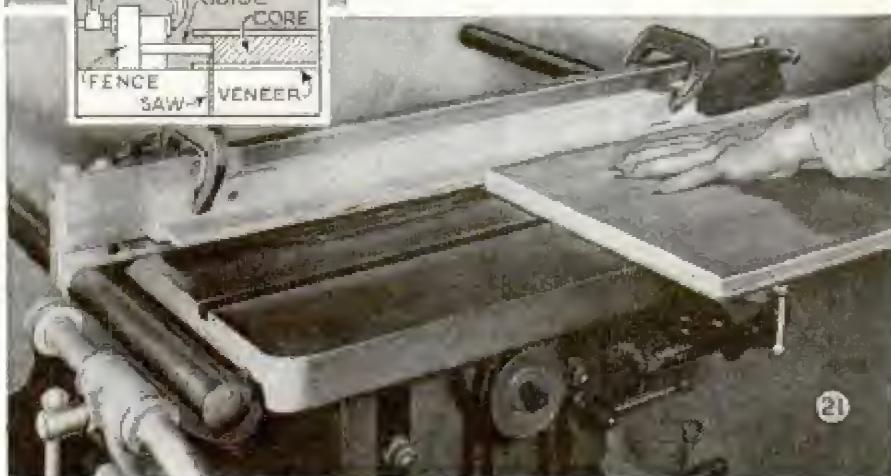
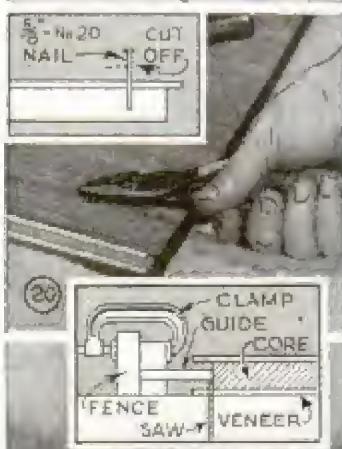
Concerning glue: Casein glue is used for most homecraft veneering. It is in dry powder form and requires only mixing with water to make it ready for use. Cold resin glue is also excellent. Both types should be applied with a brush having fairly stiff bristles. An even

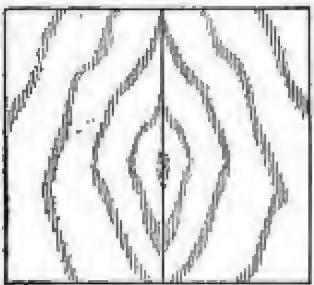


Flattening veneers

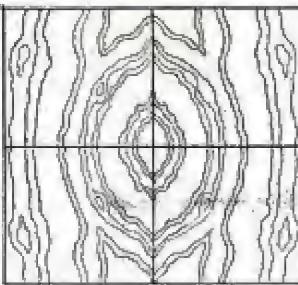
coat is essential, and is always applied to the core, not to the veneer.

Flattening veneers: Veneers are normally flat, and if kept between boards will stay that way. Intricate graining in burls and butts, however, tends to warp the veneer, and the piece must be straightened before it can be applied. Various preparation's are available for this purpose, and can be applied by brush, dip, or spray, Fig. 16. When the surface wetness has dried, the veneer is placed between boards, Fig. 17, for overnight drying. A good glue size for flattening can be made by mixing, by weight, casein glue, 1 part, water, 4 parts, and then adding slowly alcohol, $2\frac{1}{2}$ parts and glycerine, $1\frac{1}{2}$ parts.

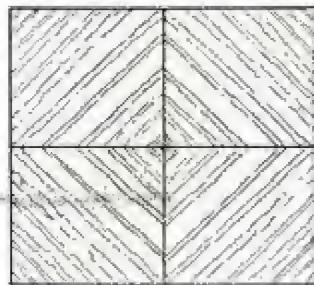




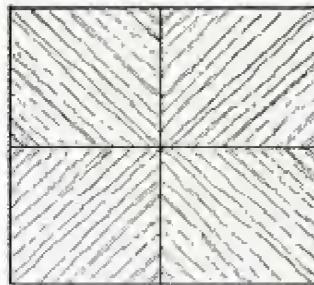
TWO-PIECE MATCH ②2



FOUR-PIECE MATCH ②3



DIAMOND MATCH ②4



REVERSE DIAMOND ②5

core. The veneer is applied and is pressed down smoothly with the hands, stroking from the center to the edges. To prevent slippage, the veneer is held in place by small brads or nails. The heads of these are cut off about $\frac{1}{8}$ in. above the surface, as shown in Fig. 20. Then the work is turned over and the veneer applied in the same manner to the opposite side. Place a double sheet of newspaper over each side to catch any glue seepage, or, use waxed cauls. Place the work between the cauls, applying pressure by hand so that the brads enter the cauls. Then put the work in the press and apply pressure. Work should remain in the press from 3 to 6 hrs. After removal, the overhanging veneer edges can be trimmed off. The pattern method of cutting on the saw, Fig. 21, gives a very clean edge.

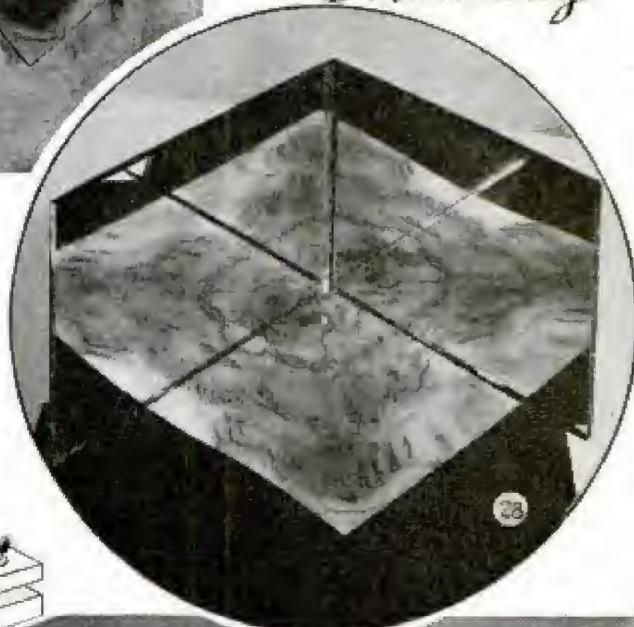


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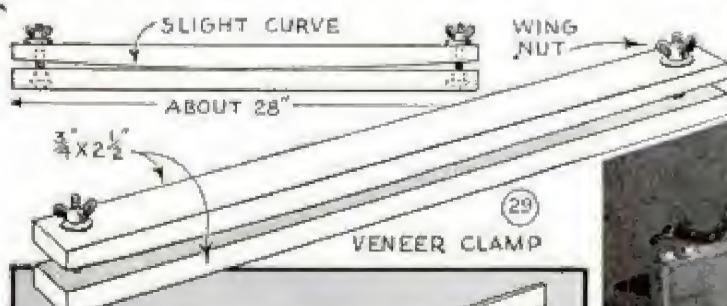


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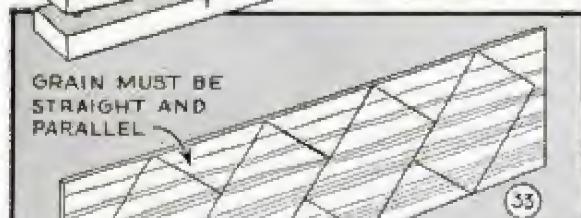
Matching



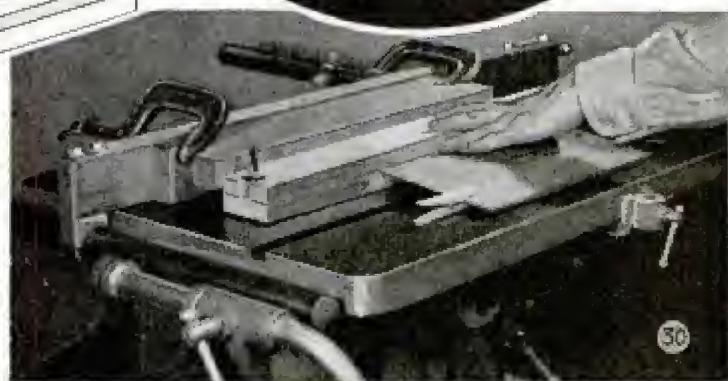
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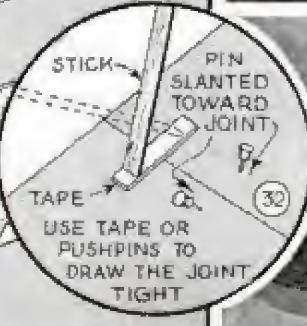
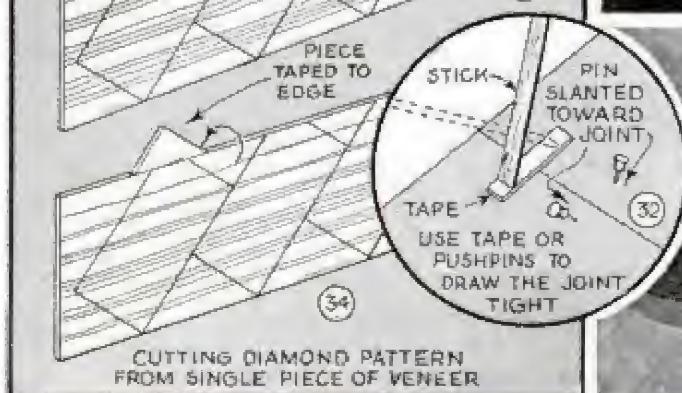
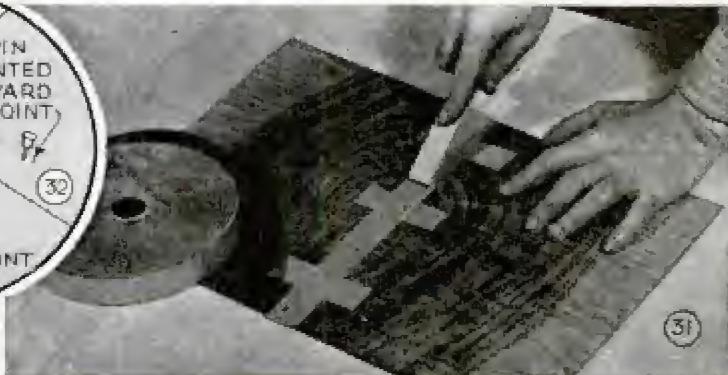
VENEER CLAMP



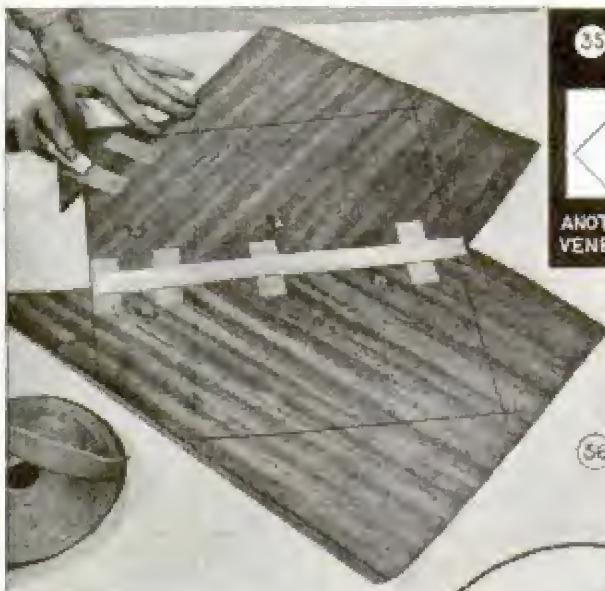
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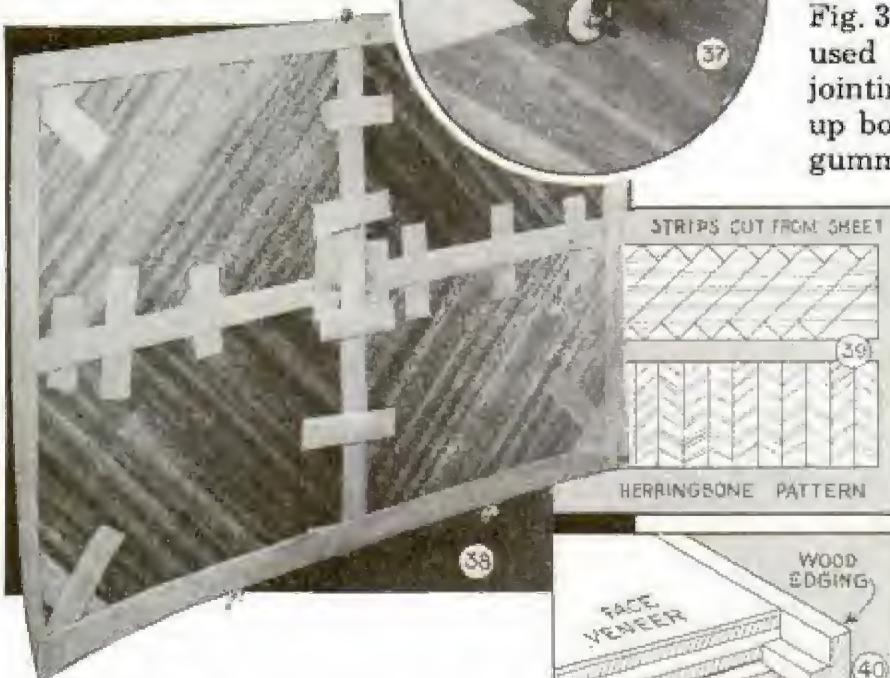
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CUTTING DIAMOND PATTERN
FROM SINGLE PIECE OF VENEER

③1



Forming a diamond match



Matching: Veneer faces are not always in single widths but are often made up of two or more pieces. Frequently the various pieces are matched to form pleasing figures, a few examples of which are shown in Figs. 22 to 25. The two-piece match requires two identical consecutive sheets of veneer, while the four-piece match requires four identical pieces. Diamond patterns can be cut from either consecutive sheets or from a single sheet. In developing four-piece figures, a pair of small mirrors can be used to advantage. Fig. 26 shows one sheet of four



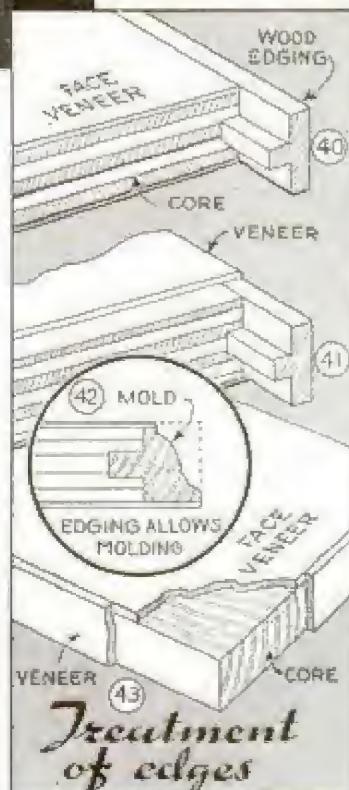
ANOTHER METHOD OF CUTTING VENEER FOR DIAMOND MATCH

consecutive sheets. The appearance of any area on this sheet in a four-piece match can be observed by covering two edges of the area with paper, Fig. 27, and placing the mirrors on the other edges, as shown in Fig. 28. Moving the paper and mirrors around will reveal the most pleasing figure.

In jointing veneers edge to edge, it usually is necessary to hold the two sheets of veneer in a suitable clamp, as shown in Fig. 29. About $\frac{1}{8}$ in. of veneer should overhang the edge of the clamp. Jointing can be done with a plane, a jointer, with sandpaper glued to a length of wood, or by pattern sawing. Pattern sawing, Fig. 30, is similar to the procedure used for trimming edges. After jointing, the two sheets are opened up bookwise, and assembled with gummed-paper, Figs. 31 and 32.

Making a diamond pattern:

How the four pieces for a diamond pattern can be cut from a single sheet of veneer is given in Fig. 33. Fig. 34 shows how the length of the panel can be increased by patching. Fig. 35 shows another method of cutting, employing two consecutive sheets. The assembly of a diamond cut in this manner is shown in Fig. 36.



Treatment of edges

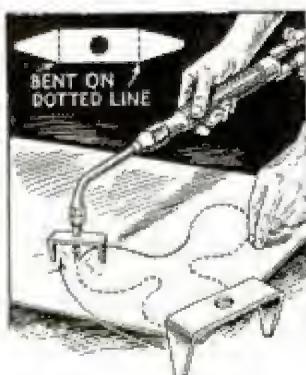


Two consecutive sheets of veneer will give a perfect match at one joint, while the other joint will be an approximate match depending on the continuity of the grain. In this respect, mahogany gives almost perfect results even when all four pieces are cut from the same sheet. After each joint has been taped, the edges can be folded back and glue applied to the veneer edges with a small roller, Fig. 37. Fig. 38 shows the completed diamond pattern, all ready for the press. The familiar herringbone pattern, Fig. 39, is made much the same as the diamond except every other piece is turned over.

Treatment of edges: The edges of a lumber-core panel require no treatment and can be molded and finished the same as a solid piece of wood. Edges of veneer cores are frequently finished dark with burnt umber to conceal the layers of veneer. A better method is to use an edging of the same wood as the face veneer, as shown in Figs. 40, 41, and 42. The edging can be applied either before or after the veneer is laid, the neatest method being to veneer over the edging. The strips should be mitered neatly at the corners, as can be seen in Fig. 44. Where the edges of the core are veneered, Fig. 43, the end grain of the core must be well sized with glue in order to secure good adhesion.

(To be continued)

Simple Cutting-Torch Guide for Flat Work

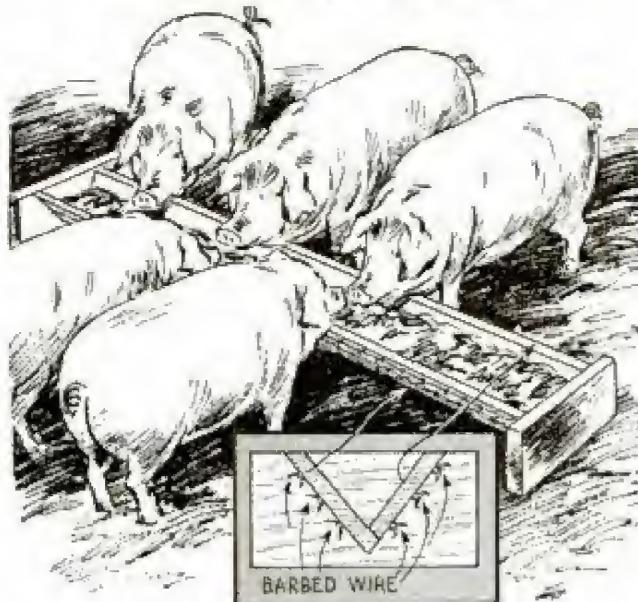


This little clip will be found an aid in cutting designs from flat work with a torch. It is made from thin steel and the ends that slide on the work are ground smooth so that they move easily over the

work. In use, the torch tip is simply rested in the hole of the guide, which helps to support it as it is moved.

All painted surfaces should be washed before repainting them, to remove film of oil, grease, dirt and stains. Also less paint is required if this is done and often a coat of paint is saved.

Barbed Wire under Trough Edge Prevents Hogs Tipping It

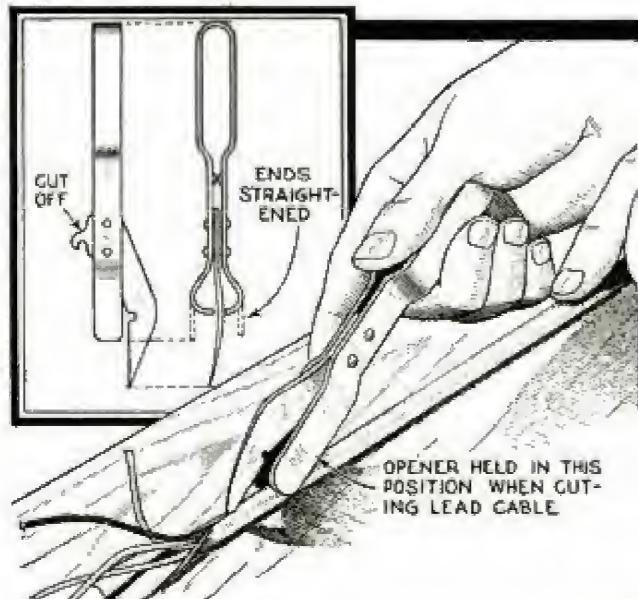


To keep his hogs from rooting and overturning the feed troughs, or from spilling the contents at feeding time, one farmer fastened lengths of barbed wire under the edges of each side. Regular staples were used to attach the wire, which was stapled at 1-ft. intervals.

Covering of Armored Cable Removed with Can Opener

Electricians and others who have to open the ends of lead cables will find that the job can be done quickly with a can opener of the type shown. Slit the rounded end with a hack saw and straighten the severed ends to act as a guide on the cable. Then sharpen the cutting edge of the blade and use it as shown.

—Herman R. Wallin, New York, N. Y.



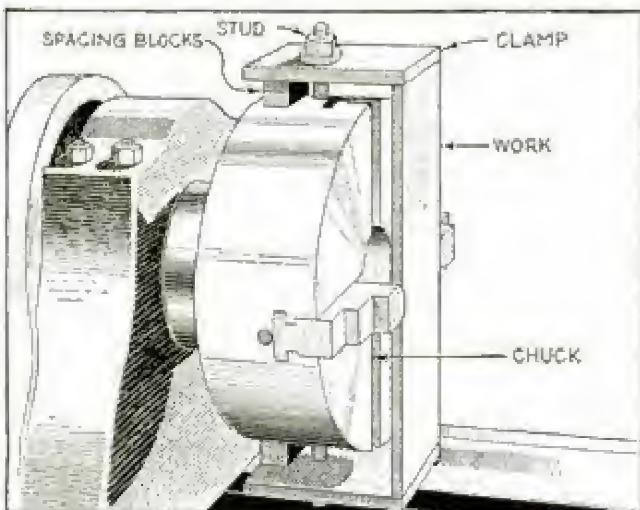
Sleeve Made from Piece of Dowel Keeps Toggle Bolt Tight



If a block of wood or other work is to be fastened to a hollow wall surface with a toggle bolt, insert a sleeve in the hole as shown to prevent the bolt from working loose. A sleeve for the purpose can be made by drilling a hole lengthwise through a dowel to take the bolt. This will fill in the space between the bolt and wall for a snug fit, besides keeping the edges of the hole from crumbling while the bolt is tightened.—A. Vena, New York, N. Y.

Increasing Capacity of Chuck

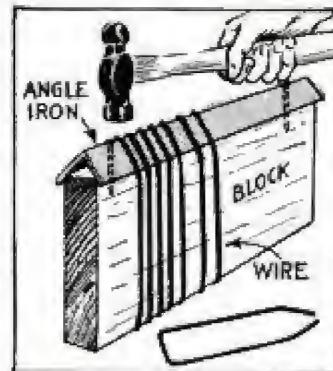
When work with slightly irregular surfaces has to be faced on one side, it can be chucked in a lathe in the manner shown. Two of the jaws on opposite sides of a four-jaw chuck were removed and stud



bolts were substituted for the screws. These held clamping pieces against the ends of the work as indicated, while the remaining jaws of the chuck gripped the edges of the work.

Tie Wires Cut in Equal Lengths with This Simple Jig

To cut tie wires for concrete forms quickly, a contractor made this jig. Lengths of the wires are varied as required by using blocks of different widths. Besides cutting the wires, it also shapes them.



Guides Prevent Team of Horses from Crowding Gate Posts



As an aid in driving a team of horses through a narrow gateway so that the wagon or farm implement will not strike the posts at either side, fasten a couple of sections of auto-tire casing on top of the posts as shown. The horses will avoid these apparent obstructions and keep the vehicle in the center of the roadway.

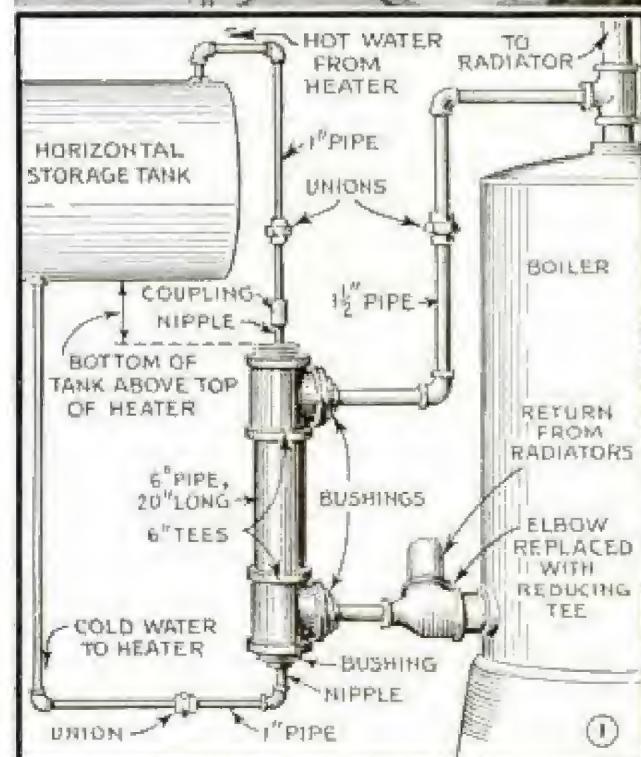
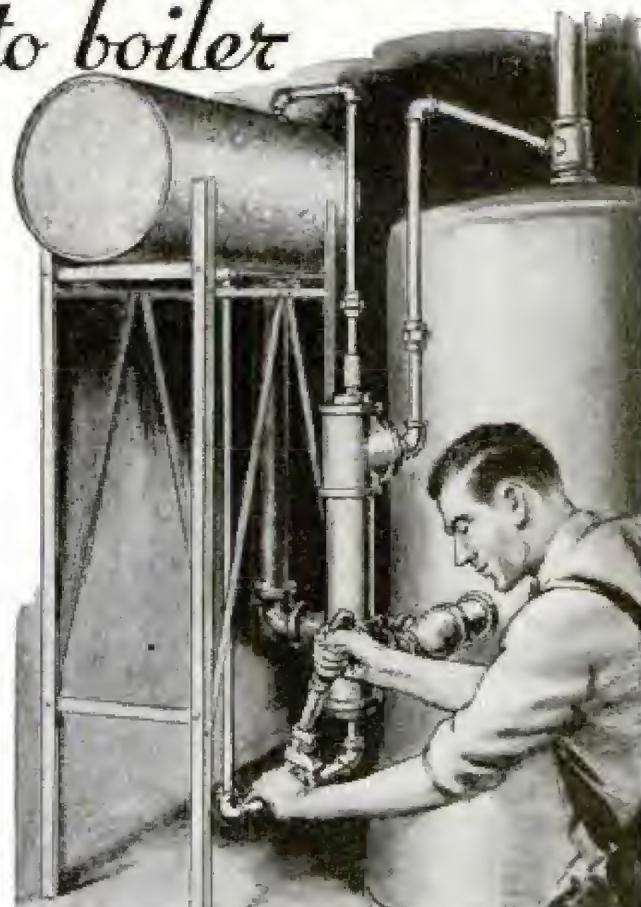
Late October is a good time to paint your house as there is usually less rain and fewer insects at that time than in either hot or cold weather.

Indirect WATER HEATER connects to boiler

By J. B. MULLEN

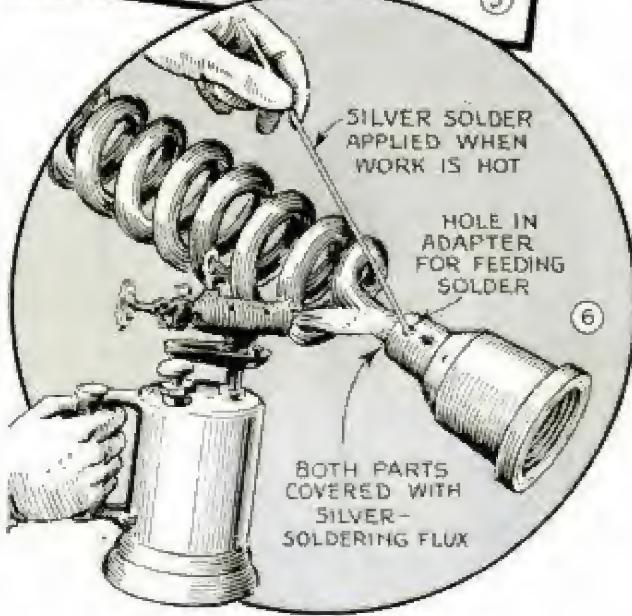
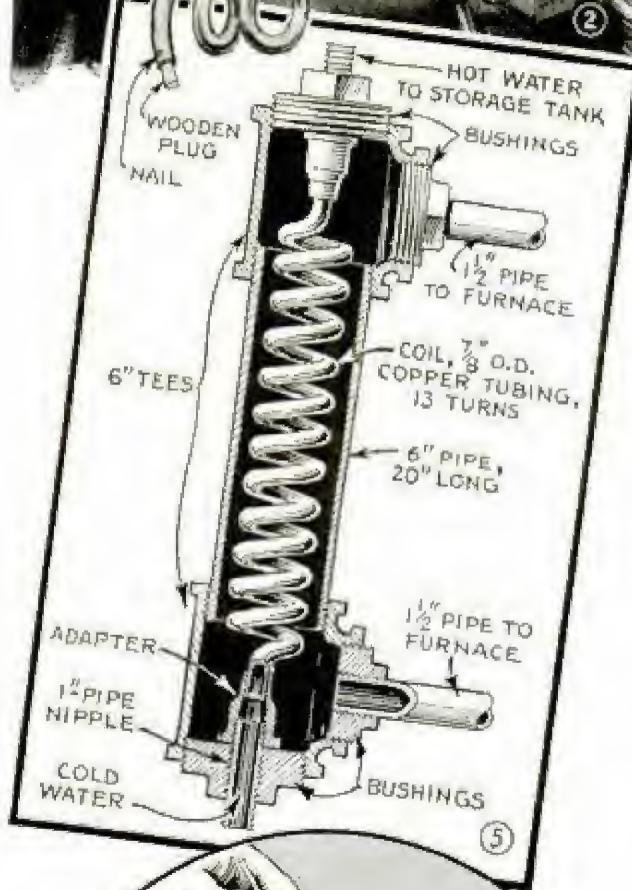
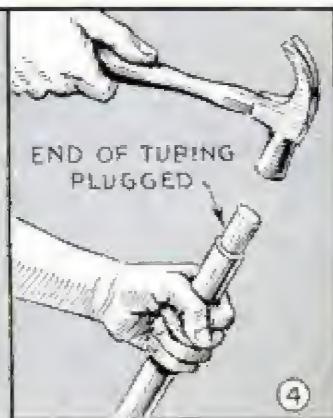
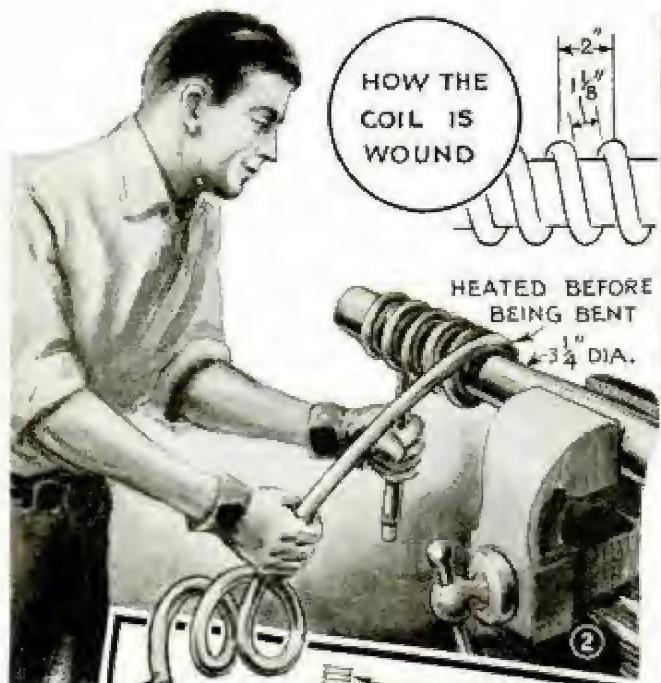
ASSEMBLED from standard copper tubing, pipe and fittings, this domestic water heater connects to the boiler of a hot-water heating plant. It is especially advantageous on oil burners and gas furnaces where the temperature of the water is maintained automatically. Hot water from the boiler passes through the case and heats the water which circulates from the storage tank through the copper coil inside the case. A system of the type shown will have a capacity of 20 gals. of hot water per hour, which will be adequate for the average home, if the boiler-water temperature is maintained at 180° F. or higher, and a 60-gal. storage tank is used. A general layout for the system is shown in Fig. 1. The heating unit consists of a copper coil enclosed in a length of 6-in. standard pipe.

The coil is wound from a 15-ft. length of 18-gauge, soft-copper tubing having an outside diameter of $\frac{7}{8}$ in. For winding, it is filled with dry sand and the ends plugged, Figs. 3 and 4. It is best to cut the tube somewhat long and then cut off the surplus after bending. The sand-filled tube while hot is then wound around a mandrel 3 $\frac{1}{4}$ in. in diameter, as shown in Fig. 2, making thirteen evenly spaced coils 1 $\frac{1}{8}$ in. apart. After the coil has been finished, the ends are stretched out straight along the axis of the coil, plugs are removed from the tube and the sand shaken out. In shaping the coil it is essential that sharp bends be avoided. Each end is fitted with an adapter such as shown in Fig. 6, for connecting to the iron pipe. There are several types of fittings for this purpose. The one shown has a $\frac{7}{8}$ -in. socket at one end into which the copper tube should be silver-soldered, and a 1-in. pipe-threaded opening at the other end. The end of the tube and the inside of the fitting are cleaned with fine emery cloth and coated with brazing flux. The parts are then fitted together and heated. Silver solder is applied through a hole when the joint is hot enough. If you plan to use the hot-water



system in summer as well as in winter, a gate valve will be necessary in the line to the radiators to prevent heating them.

The heater can now be assembled as in Fig. 5. First, the bushings are installed in the lower tee and a long, 1-in. pipe nipple is run through the lower bushing. All



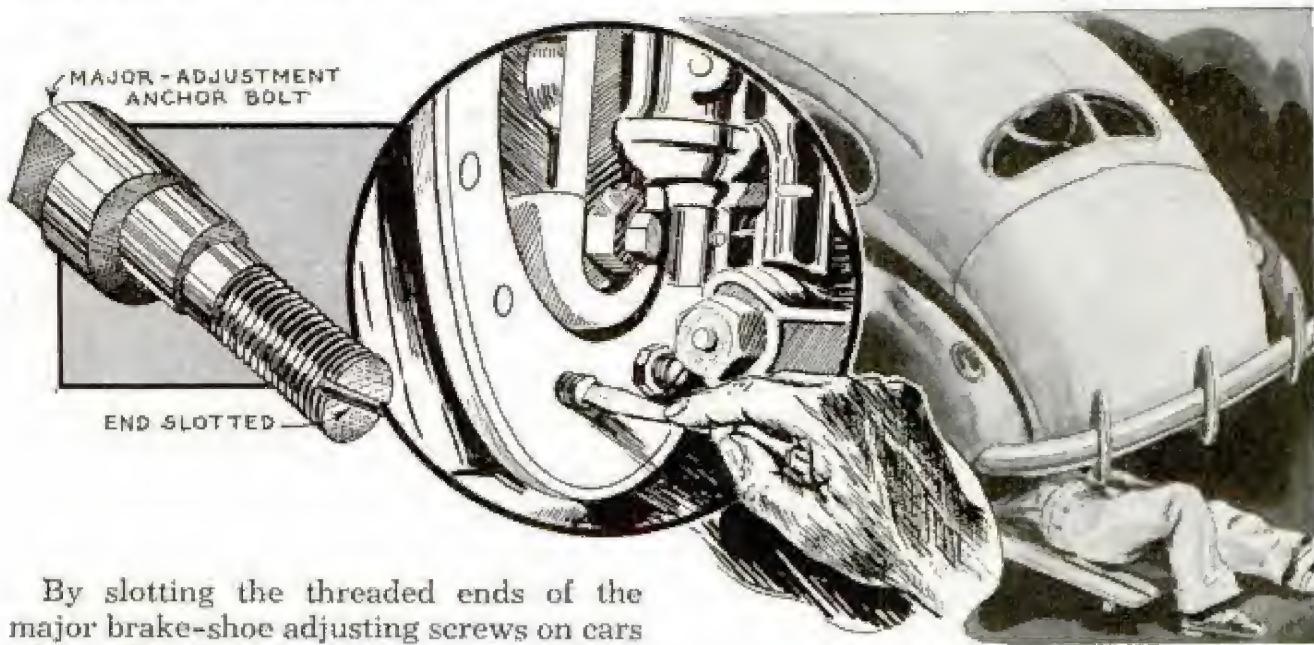
threaded joints must be calked with a good pipe-thread compound. This tee is then attached to the lower pipe from the boiler. The coil is attached to the nipple which extends through the bottom bushing, and the section of 6-in. pipe is screwed to the tee. The upper tee is next screwed to pipe and the bushing for the 1½-in. pipe inserted into its side arm. Do not, however, put the other bushing into this tee as yet.

Next, the upper connection to the boiler is made. A union will be necessary in this line. A nipple is screwed into the adapter fitting at the top of the coil and the bushing is screwed down over this nipple and into the tee. The nipples used for the upper and lower connections to the coil must be threaded for a distance of several inches in order to attach both to the bushing and to the coil. The connections to the water tank are made as shown in Fig. 1. It will be advisable to flush the tank out thoroughly to remove all sediment and scale before attaching to the new heater. A union will be needed in both lines to the tank. The tank should be horizontal and the bottom of the tank must be higher than the top of the heater.

Extinguishing Fire in Gas Main

While digging a ditch, a workman stuck his pick through a large high-pressure gas main, which quickly burst into flame. Because of the high pressure, firemen were unable to extinguish the fire with water or chemicals. A compressed-air pump and tank were run up near the fire. After a good head of air had been pumped up a pipe was attached to the air hose, and held as near the gas main as possible. A valve was opened, permitting a sudden rush of air. This carried the gas away from the flame and the fire died instantly.

Slotted Screws to Adjust Brakes Externally



By slotting the threaded ends of the major brake-shoe adjusting screws on cars where they face inside the brake drums, you can save time when relining the brakes. The slots enable a mechanic to adjust the newly lined shoes with a screwdriver from outside the drum. Usually on brakes of this type, dummy drums have to be used in adjusting the shoes because the screws are inaccessible when the wheels

are in place. The screw ends can be slotted with a hack saw, but first they must be ground on the ends to remove the hardened surface which penetrates only a few thousandths of an inch. Use two blades in the hack saw so the slot will take a large screwdriver.—Morris Waldman, Chicago.

Badly Clogged Radiator-Core Tubes Are Cleaned by Hand

Radiators that have become so filled with rust and sediment that no amount of flushing will restore their former cooling efficiency can be cleaned without removing them from the car. First remove the two hose connections and slip off the outer shell from the tank. Drill a hole through the top of the tank above the radiator tubes,

using a No. 36 drill. Run a long piece of $\frac{1}{16}$ -in. drill rod or other stiff metal through the hole and into one of the tubes to the bottom of the radiator to remove any accumulation lodged there. All the tubes may be cleaned in this manner, but it is unnecessary to drill a hole for each tube as the rod will reach more than one tube from each hole drilled. Forcing water through the radiator from the bottom hose connection, or even running it through from the top, will aid in cleaning the tubes. After all corrosion has been removed, thread the drilled holes with a No. 6-32 tap, insert brass screws and solder over each head.

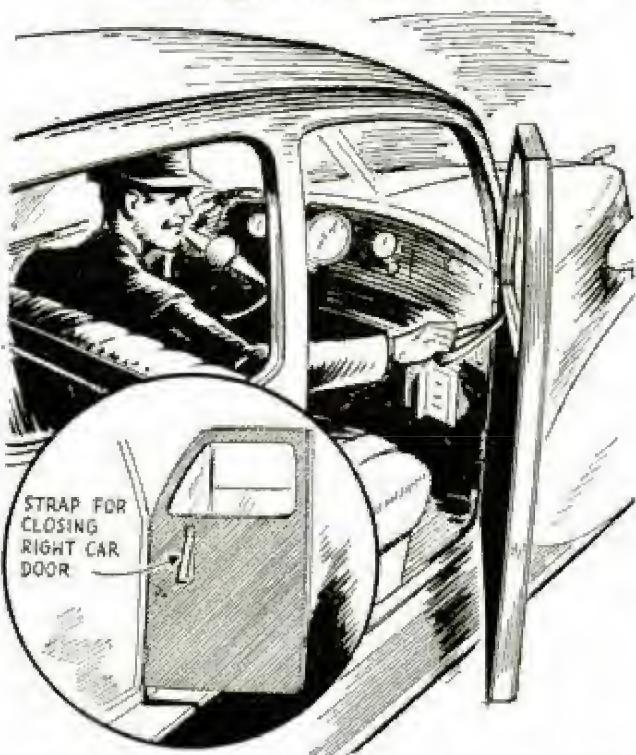
—Arthur S. Clark, Oakland, Calif.



Valve Stems Easily Scraped in Drill Press

Disliking to scrape valve stems with a knife to clean them, one mechanic chucked the stems in a drill press and held a strip of fine sandpaper against them while they rotated. Only a few minutes were required to remove carbon and polish the stems.

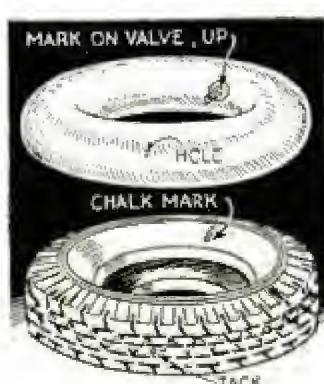
Strap Helps Driver Close Door on Right-Hand Side



Difficulty of closing a car door on the right side from the driver's seat can be avoided to some extent by attaching a strap to the door as indicated. The strap being close to the hinged side of the door is easy to reach to pull the door shut.

Locating Punctures in Tubes

Punctures in inner tubes can be located quickly without the use of water or even the necessity of inflating them. Before the tube is removed from the tire, make a chalk mark on the side of the tire directly in line with the valve stem.



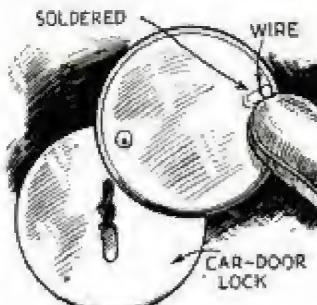
Then remove the tube and locate the nail or other object that caused the puncture in the casing. Now, if the tire is laid on the floor and the tube placed over it with the valve directly over the chalk mark, the hole in the tube will be directly in line with the nail in the tire. To avoid inverting the tube with respect to the tire, a mark should be made on the side of the valve stem corresponding to that side of the tire on which the chalk mark was made. In some cases where it is possible to locate the hole in the tube and

difficult to find the nail in the tire, the above procedure may be reversed to locate the position.

—Edward Moorman, Lawrence, Kan.

Lug on Flap of Auto-Door Lock Makes Opening Easier

Pivoted flaps that cover the door locks of some cars can be opened much easier when wearing gloves if a tiny lug is soldered to the lower edge of the flap. A short piece of brass or copper wire is ideal for this purpose, a piece about $\frac{1}{8}$ in. long being sufficient.

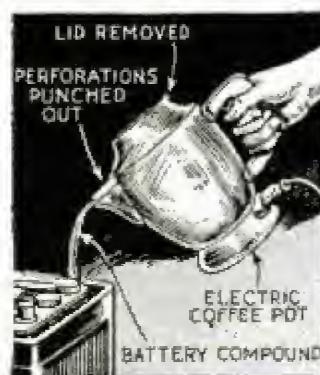


Peephole in Visor Aids Motorist When Crossing Intersections



Noticing that his sun visor restricted his view too much when approaching an intersection, one motorist cut a peephole near the right-hand end of the visor. This enabled him to take a quick look when approaching an intersection. A cover can be provided for the hole if desired.

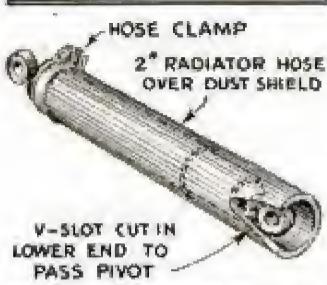
Old Coffeepot Melts Compound for Resealing Batteries



A battered, but serviceable electric coffeepot was used by a garage-man to melt battery compound for resealing the tops of repaired batteries and for filling scores and other bad spots in

batteries that are to be recharged. The lid of the pot was removed entirely and the perforations between the body and the spout were punched out to make pouring easier. The shape of the spout makes it an easy matter to apply any amount of compound exactly where it is required.

Protecting Shock Absorbers Against Gravel and Rocks

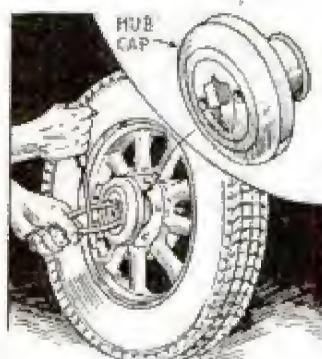


enough to cover each shock absorber completely and held in place with regular radiator hose clamps.

—Emil J. Novak, Omaha, Nebr.

Unscrewing Slotted Hub Caps

If an old car of the type having wooden wheels, which have slots in the hub caps to take a tool for removing them, comes into your shop and the caps have to be removed and there is no tool at hand, try a pair of pliers. Just insert the ends of the plier handles into the slots and use a screwdriver as shown to unscrew the cap.



Emergency Valve-Spring Repair



ends. This prevents the ends from telescoping or twisting to one side, so that the valve will continue to function until a new one can be obtained.

When a valve spring breaks and a new one is not at hand, an emergency repair can be made by placing a large washer between the broken ends.

Removable Step on Car Fender to Enter Rumble Seat



To facilitate entering the rumble seat of his car, especially for the lady members of his family, one motorist provided the extra step shown. It fits into a hole drilled in the regular fender step and is stored in the rumble-seat compartment when not in use.

Lock on Car Door Changed Over to Steering-Wheel Side

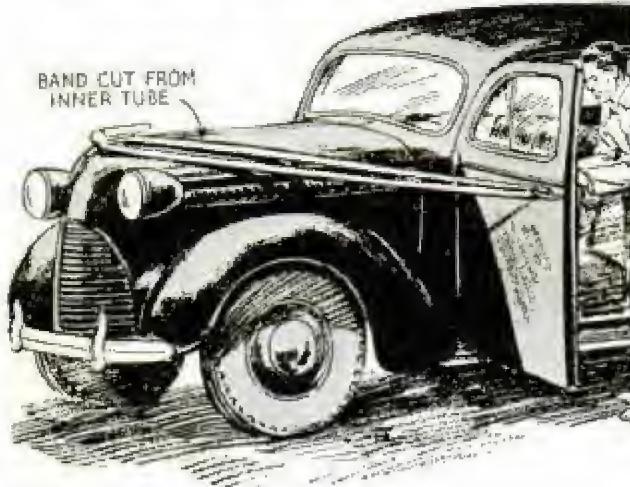
Tired of sliding across the front seat of his car many times during the day with a sample case, one salesman changed the lock on his car door over to the steering-wheel side for convenience. The lock, being of the type that operated in the door handle, was easily changed in a few minutes by merely switching the handles.

Hub Reflectors Safety Precaution When Crossing Highway

Have you ever had a bad scare when crossing a dark highway or street because an oncoming motorist did not see your car? If so, reflectors attached to the hub caps will help avoid this in the future. The reflectors should be attached near the edge of the cap so they will form a ring of light when the lights from an oncoming car strike them.



Door Held Open While Working on the Window Mechanism



To hold car doors open while repairing the window, one mechanic uses a long rubber band slipped over the door handle and the radiator ornament. The band is cut from an old inner tube.

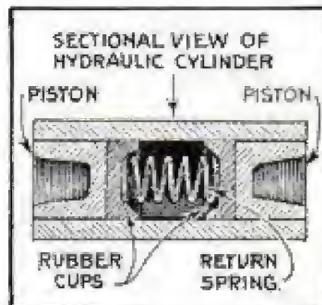
Multiple Posts on Car Ammeter for Connecting Accessories

All the accessories on my car, such as radio, heater, cigar lighter, etc., were connected to one post of the ammeter, and when one of them had to be disconnected, all the wires came off. I drilled several

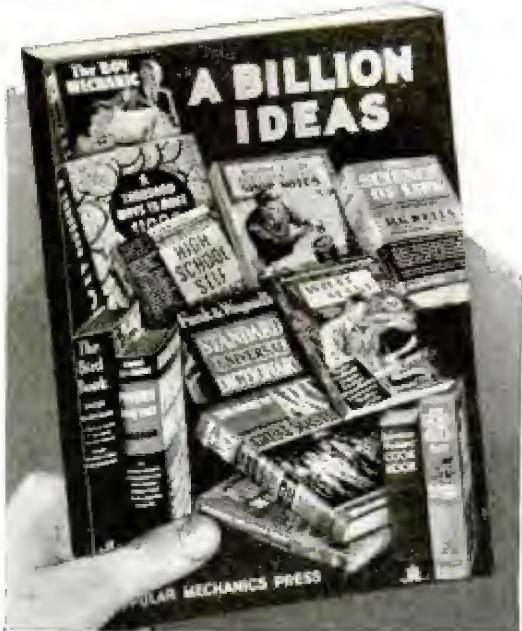
small holes in a strip of brass and connected it to the ammeter post. Now the wire from each accessory can be fastened in one of the holes and removed without disturbing the others.—W. Waters, Alton, Ill.

Reserve of Brake Pedal Reduced by Air in Wheel Cylinder

After long use of hydraulic brakes, it is sometimes difficult to keep the proper pedal reserve for more than a few days. In some cases this is due to air getting into the rear-wheel cylinders when the hand brake is used. When this brake is set, the pressure of the fluid on the wheel cylinder is removed and if the brake-cylinder rubber cups or the walls of the cylinder are not in good condition, atmospheric pressure forces air into the cylinders, causing a loss of pedal reserve. Repairing with the necessary parts, or the replacement of the entire wheel cylinder if the walls are in bad condition, will cure the trouble.



Arm Yourself with Ideas for Success By Getting This New 128-pp. Guide to Opportunities

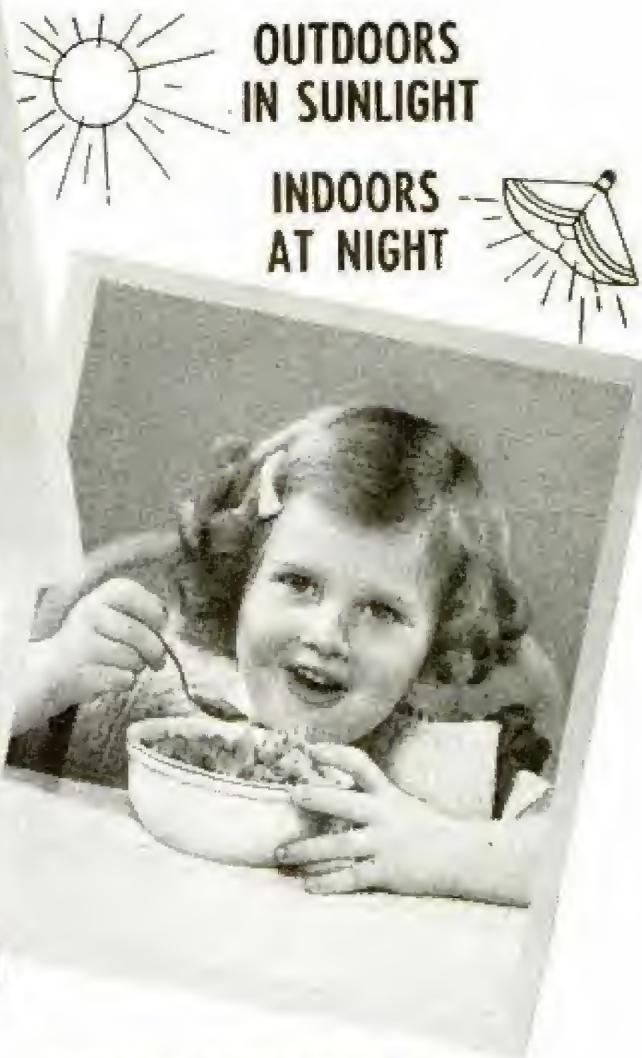


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is a winner!



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at night

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Above, special tool for changing tires on the Plymouth. Right, cross-section view of safety rim wheel shows how bead of flat tire is held firmly on wheel. Center, Lincoln Custom limousine. Bottom, how license plate is mounted between bumper guards on Buick



Lincoln

The 1941 Cars

(Continued from Coloroto Section)

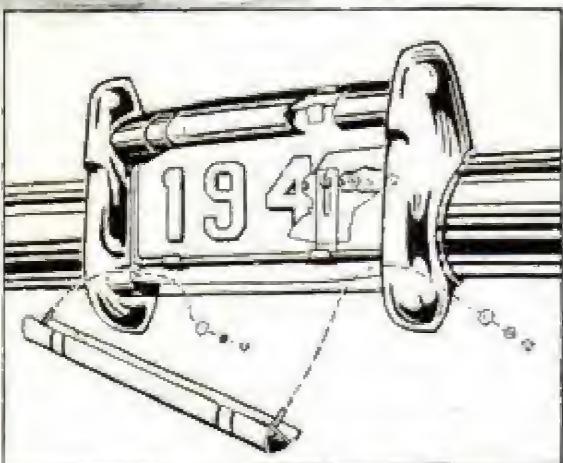
out shifting gears or operating the clutch. Dodge, like Plymouth, offers at extra cost a booster mechanism for helping the driver to shift gears in cars equipped with standard transmission. Other Dodge features include increased engine power, the safety rim wheel, rear windows giving forty-seven per cent more vision than did last year's windows and a counterbalanced lid for the luggage compartment.

K837

Changes in the Ford cars are more extensive than for any year in the last five. Bodies are much larger and wider, so wide, in fact, that running boards are partly concealed. Both Ford cars are powered by the eighty-five horsepower, eight-cylinder engine, the "60" being discontinued. The wheelbase is increased to 114 inches and the cars are mounted on an extremely rigid frame of new design. Springs are softer and rear springs are longer. A feature of the convertible club coupe is an automatic top operated by electric motors instead of by vacuum.

The Mercury Eight features new lines, longer wheelbase and an improved ride. The wheelbase is 118 inches. Longer rear spring, improved shock absorbers of the double-acting hydraulic type, five-inch rims and 6.50-inch tires, a perfected torsion bar and other factors contribute to a comfortable ride. Mercury bodies are wide, with running boards partly concealed. There are three distinct lines of Lincoln automobiles for

(Continued to page 116A)

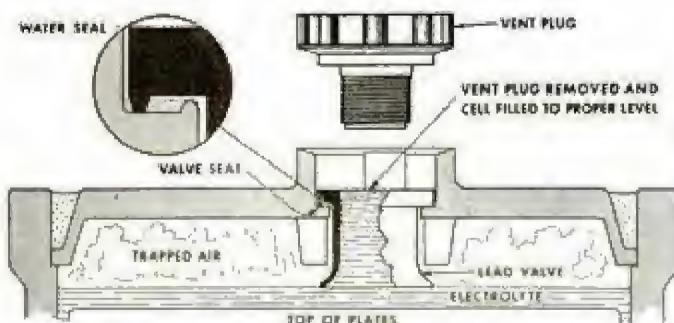


The New **DELCO ELECTRO-LEVEL**
AUTOMATICALLY ELIMINATES
OVERFILLING

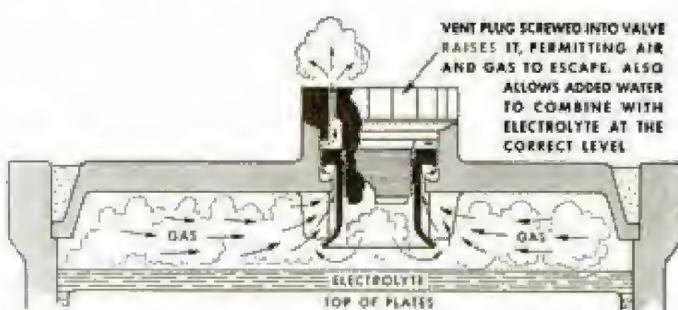


When the electrolyte level in a battery is too high, acid is sprayed through the vent holes by the pressure inside the cell . . . pressure that is built up by the release of gases when the battery is being charged. This acid spray attacks battery connections and battery carrier. The new Delco battery is protected against these conditions by the Delco Electro-Level, which automatically prevents overfilling when water is added.

HOW THE DELCO ELECTRO-LEVEL WORKS



Vent plug removed for filling—valve forms air lock when electrolyte reaches proper level. Notice particularly the *water seal* formed when the edge of the valve drops into the layer of water retained by the ridge around the valve seat. This layer of water is replenished by condensation, eliminating any possibility of a leak in the air lock when the lead valve is in position for filling.



Vent plug screwed in—valve is raised to permit escape of trapped air and gases from the cell through the passage and the vent hole in the plug. Notice here the efficient baffle arrangement through which the gases must pass. This condenses moisture and breaks up the acid spray which might otherwise escape to damage the battery carrier and connections to the battery.

Stop in at your nearest Delco battery dealer's and let him check your present battery on the Battery "Life Expectancy" Chart. He has a Delco battery that is exactly the right size and type for your car.

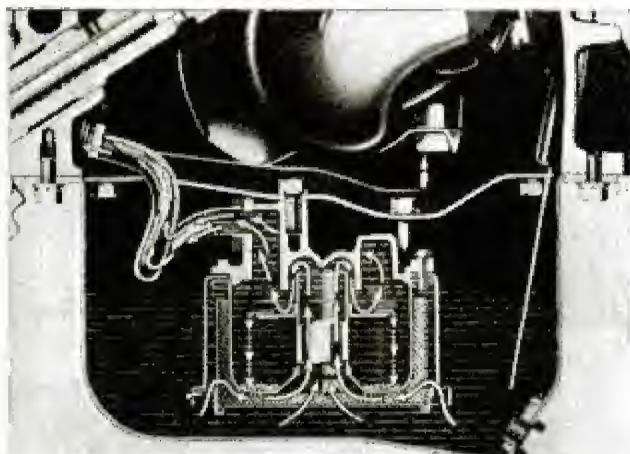
Delco-Remy

ANDERSON, INDIANA

World's Largest Manufacturer of Automotive Electrical Equipment

1941—the Lincoln-Zephyr, the Lincoln Continental and the Lincoln Custom. All have the unit body-and-frame construction which provides great strength and safety with low weight. The Zephyr and Continental are mounted on a 125-inch chassis, while the Custom is on a 138-inch chassis. All are powered by a V-type 12-cylinder engine of 120 horsepower. The Custom features door windows which operate automatically by merely pressing buttons. Instead of door handles, the Lincolns are equipped with push-button door latches.

Studebaker's offerings for 1941 are highlighted by a slipstream Land Cruiser, a long, low, wide, sleek-looking model that already has won the approval of automotive engineers, writers and dealers. In ad-



Sectional view of Pontiac engine showing oil cleaner through which all oil passes before reaching bearings. Filters, traps and baffles precipitate impurities in the oil

dition, the popular-priced Champion is continued. With its eighty-horsepower, six-cylinder engine operating at a 6.5 to 1 compression ratio, the Champion has surprising pep in traffic, as well as satisfying economy under most driving conditions. Although wider, longer and roomier, the Champion still weighs less than 2,500 pounds, thus maintaining its low weight per horsepower rating. The Studebaker Commander has a six-cylinder engine delivering ninety-four horsepower, the President an eight-cylinder motor developing 117 horsepower.

The Nash 600 is a full-size automobile, 194 inches over-all, fitted with a six-cylinder engine with the manifolds sealed into the block. Body and frame are welded into a unit to give great strength. It has no running boards. One feature is coil spring-

ing on all four wheels, a means of achieving a "soft" ride. The 600 is smartly styled, in the manner of the larger models, the Ambassador Six and the Ambassador Eight. The Nash designer makes use of the "fast back," a sloping contour from roof line to the bottom of the luggage compartment, with no bulge at the trunk level.

Willys' Americar has a wheelbase of 104 inches and an over-all length of 181 inches. Its four-cylinder engine has power increased by eight per cent from 1940, to sixty-three horsepower at 3,800 to 4,000 revolutions per minute. Helical gears are used in both high and reverse speeds and the car has a hypoid rear axle. Economy has been improved, and under defined conditions the car is capable of thirty-five miles per gallon. Steering-post gearshift is standard. The Americar is equipped with oversize hydraulic brakes, all-steel body and a frame three times stiffer torsionally than that of the 1940 Willys.

De Soto, offering the Fluid Drive at extra cost, has a 105-horsepower engine and a wheelbase of 121½ inches. Like Dodge it has the counterbalanced luggage compartment lid, the safety rim wheel, two-spoke steering wheel that gives full view of the instrument panel, new long-life bearings and the safety speedometer with indicator showing different colors at different speeds. Simplimatic Transmission, consisting of a power shifter that makes gear shifting a fingertip proposition, is optional with the standard transmission.

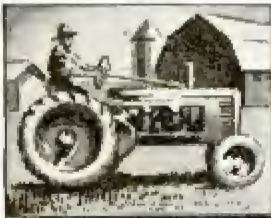
All models—Royal, New Yorker and Crown Imperial—in the Chrysler line have more horsepower than they had last year. Gravel deflectors are provided front and rear; the license bracket is mounted on the gravel shield. One feature is substitution of electric windshield wipers for the vacuum type common to the industry. Instead of depending upon the engine for the vacuum power to operate them, these electric wipers are operated by two electric motors, thus insuring constant speed regardless of engine speed. An automatic circuit breaker disconnects the wiper circuit when the windshield becomes covered with snow to the extent of overloading the circuit. The circuit breaker automatically resets the circuit after the overload has been removed, thus preventing fuses from blowing out. All doors are equipped with a

(Continued to page 118A)

The Inside Story of a Chemical Miracle That Cuts Motor Operating Costs



Easy to install on cars of all makes.



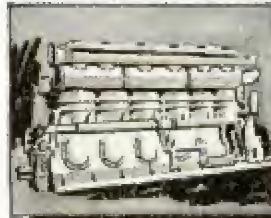
Cuts tractor oil bills, repair bills, too.



Saves mid-season marine oil changes.



First Choice of Fleet Owners the nation over.



Reduces maintenance costs on Diesels and stationary engines.



Guaranteed to Save You Money on Oil Bills and Motor Repairs

Sludge and impurities in motor oil clog up pump screens, stop up oil lines, form in the ring grooves, oil ring drains and on valve stems. They cause sticking rings and valves, abrasion of moving parts, lead to big repair bills. Until the invention of the Fram Oil & Motor Cleaner, you had to change oil every thousand miles or so to keep a motor in good condition. Even then, the acids and corrosives that form in even the best oil in normal motor operation, shortened engine life and meant early loss of power and efficiency.

KEEPS BOTH OIL AND MOTOR CLEAN

But Fram has shown more than 2,000,000 motorists how to put an end to frequent oil changes—and how to cut down repair bills caused by dirty, chemically-contaminated oil. For Fram is more than an oil filter. The result of years of chemical research, Fram does more than strain out dirt, carbon, abrasives and sludge which dirty up new oil almost as soon as you put it in a motor. Fram keeps the inside of the motor clean, too. And its patented, chemically-impregnated cartridge impedes the formation of acids and corrosive chemicals. A Fram keeps oil physically, visibly and chemically clean—makes a crankcase of oil give "new oil" service for many thousands of miles without changing.

READ FRAM'S GUARANTEE

Then drive in where you see the Fram Authorized Dealer Sign shown below. Install a Fram—and put yourself on the road to savings. Or mail the coupon with 20c for your Fram patented Dip-Stick and complete information about Fram, the Miracle Oil & Motor Cleaner.

FRAM CORPORATION
Formerly Fleming Mfg. Co.
PROVIDENCE, R. I.

FACTORIES: East Providence, R. I. and Ann Arbor, Mich. CANADIAN DISTRIBUTOR: J. C. Adams Co., Ltd., Toronto. ENGLAND: Simmonds Accessories Ltd., London. FRANCE: Etablissements A. Guiot, Paris.



If You Had X-Ray Eyes

here's how a Fram would look to you. (1) Dirty oil goes in here; (2) Passes through chemically-impregnated cartridge as indicated by arrows; (3) comes out here clean. The patented chemically-treated cartridge removes impurities, impedes formation of acids and chemical corrosives in the oil. Cartridge is packed in metal container. Won't rupture or dump dirt into the oil stream.



Mail Coupon and 20c for Patented Fram Dip-Stick

Fram's patented Oil Condition Gauge (Dip-Stick), now available for most popular cars, ends guess-work about the condition of your motor oil. When you can't read the word "Clean" through the film of oil on the Dip-Stick, it's time to change your oil, install a Fram, and put the need for frequent and costly oil changes behind you forever. Or, if your car is already filter-equipped, it's time to replace with a genuine Fram Cartridge. Don't guess about your oil. Get your Fram Dip-Stick now. Send 20c with the coupon. We'll mail it at once—postpaid.

SEND 20c FOR SPECIAL FRAM DIP-STICK

FRAM CORPORATION, Providence, R. I.

Enclosed is 20 cents (coin or stamps) for which send one patented FRAM Dip-Stick for car checked:

- | | |
|---|--|
| <input type="checkbox"/> Buick, 1938 Model 40 | <input type="checkbox"/> Ford, 1937-40, 60 H.P. |
| <input type="checkbox"/> Buick, 1939 Model 40 | <input type="checkbox"/> Nash, 1936-38, Model 400 & Nash-Lafayette 1937-40 |
| <input type="checkbox"/> Buick, 1940 Models 40 & 50 | <input type="checkbox"/> Packard, 1940, 6 & 120 |
| <input type="checkbox"/> Buick, 1940 Models 60, 70, 80 & 90 | <input type="checkbox"/> Plymouth-Dodge, 1935-40 |
| <input type="checkbox"/> Chevrolet, 1935-36 | <input type="checkbox"/> Pontiac, 1935-40, 6-cyl. & Pontiac, 1935-39, 8-cyl. |
| <input type="checkbox"/> Chevrolet, 1937-40 | <input type="checkbox"/> Pontiac, 1940, 8-cyl. |
| <input type="checkbox"/> Chrysler, 1937-40, 8-cyl. | <input type="checkbox"/> Studebaker Com., 1939-40 |
| <input type="checkbox"/> Chrysler, 6 & DeSoto, 1937-40 | <input type="checkbox"/> Studebaker Pres., 1939-40 |
| <input type="checkbox"/> Ford, 1935-40, Models 85, 95 & Mercury | |

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K9 6

stay-open check that holds them open for easy entrance or exit. Each gauge on the instrument panel has a warning signal which lights up, for instance, if oil pressure is weak, gasoline supply low, water temperature too high or the ammeter discharging too rapidly. Chrysler models also have the safety rim wheel and the two-spoke steering wheel. Running boards may be replaced by chrome-trimmed side shields.

Nineteen-forty-one will be a colorful motoring year. Hudson introduces Symphonic Styling, the application of harmonizing line and color, which makes available, at no extra cost, a wide selection of interior color combinations that harmonize with exterior colors. There are three basic color harmonies, grey, tan and green. Pontiac presents solid exterior colors such as black, Marlboro blue, Parma wine, Saratoga grey, tropic blue, Alandale green, Indiana beige and taffy tan, plus these two-tone combinations: El Paso beige with Indiana beige, paddock grey with Marlboro blue, silver French grey with Saratoga grey, Thetis green with Alandale green, French copper with taffy tan and Santone with Parma wine. Upholstery and fittings to match or contrast are available. The Plymouth is available in eleven standard colors, most of them polychromatic, including Mandarin maroon, metallique green, Jib green, West Point gold, flight grey, Plaza brown, gunmetal, Airwing grey, Eddins blue, aviator blue and black. Besides these, four different two-tone color combinations are offered. Eight solid colors and four two-tone combinations are the choices on the De Soto. When the purchaser decides on the exterior color that pleases him, he automatically gets an interior specifically designed to harmonize with that color.

Chrysler is finished this year with a liquid plastic that holds new-car appearance for years, retains luster permanently, will not fade, does not rub off and requires no expensive waxing and polishing. Before the car body receives the primer coat, it goes through twelve cleaning and rust-proofing operations. Then six coats of finishing liquid plastics are applied, each baked on in a special induction oven to insure thorough, even curing all the way through.

Six series—three six-cylinder, 100 horsepower and three eight-cylinder, 110 horse-

power—make up the Oldsmobile line. Wheelbases of all are longer than those of 1940, the smallest being 119 inches and the largest 125 inches. The Dynamic Cruiser series replaces the "70" of last year; bodies in this classification feature a long, low arching sweep from windshield to rear bumper. Automatic door switches turn the dome light on and off. One feature is a neat grouped plug-type connection which replaces the customary tangle of wires beneath the dash and behind the instrument panel. Another is the drain incorporated into the cylinder head to prevent water from accumulating around the spark plugs. Olds' Hydra-Matic Drive, which eliminates clutch, clutch pedal and which shifts gears automatically, is available, at extra cost, on all models.

In the Buick, the speedy-looking car with sloping rear end is known as the Sedanet. It is a six-passenger model set low to the ground. All Buicks are five-eighths to two and three-fourths inches lower than last year's cars. Individual steps, concealed by the lower edge of the doors, replace running boards. Sedans in the upper price brackets are equipped with dome light and courtesy lights, two at the lower edge of the front seat and two in the rear compartment, which are turned on automatically by door jamb switches.

A specially designed spark plug, patterned after insulators on power lines, is introduced by Hudson. The porcelain insulator sleeve on the plug is fluted, or ridged, by "petticoats" which minimize accumulation of grease and add to surface length of the insulator with a consequent reduction in short-circuiting tendencies.

Packard enters another year with the distinctive front end, but the straight lines appear modified. Among the features is a window-operating mechanism that rolls the glass up or down at the touch of a button. For individual operation, buttons are located on the instrument panel and in the rear compartment. Packard continues, as optional equipment, the air-conditioning plant introduced in 1940. The capacity is rated at one and one-half tons of melting ice in a twenty-four hour period at a speed of sixty miles per hour. Each Packard equipped with air conditioning has special insulation in roof, sides and floor to reduce the amount of heat leaking into the car from the outside.



HE RODE A METEOR FOR 24 HOURS

USING CHAMPION SPARK PLUGS!



Ab Jenkins, Speed King and Mayor of Salt Lake City, wired,

"Am happy to have broken all world's endurance records with 84 new marks. One of the things I never have to worry about is my Champion Spark Plugs. They've never let me down. Throughout entire 24 hours I never had a sputter."

Ab Jenkins

RIDING HIS CHAMPION-EQUIPPED "Mormon Meteor III" over the Bonneville Salt Flats (Utah) Ab Jenkins smashed all existing records for distances from 50 kilometers to 3,000 miles and set a 24-hour record of 161.18 miles per hour.

Champion Spark Plugs are the choice of champions everywhere because they make every engine a better performing engine as strikingly demonstrated in this phenomenal event. Logically they should be your choice because your car deserves the championship performance exclusive to Champions.

Install dependable Champions now and feel the fresh surge of power, speed and acceleration they bring to every engine. You'll profit too by increased efficiency and economy.

USE THE SPARK PLUG CHAMPIONS USE

KYII Automobiles of Tomorrow

(Continued from page 667)

Entirely practicable, such a car could be built now—and introduced along with the new 1941 motoring creations—except for one thing, and that is a part of the psychology of the car buyer, himself. While every automobilist is greatly intrigued by sweeping innovations and radical departures in motorcar designs, he has not within him the ability, or the inherent willingness, to accept great changes rapidly.

Suppose the manufacturer suddenly "transplanted" the motor from the front to the rear of the car—doing away with the hood. The driver, compelled to sit 'way up in front of the car, would have an entirely new and, I am afraid, confusing driving outlook. In fact, he would feel as though he were exposed to all sorts of dangers. So, the car of the future, even though its engine is in the rear, must be designed so as to have some semblance of a hood. The resulting space can be made into spacious and convenient storage compartments. While his seat may be considerably nearer the front bumper, the driver will not feel that his position has been changed materially. He will feel safer and will be safer, with some construction ahead of him to take up the impact of possible collision.

The power plant will take up far less space in the "tail" of the car than the engine does now. Under the present-day hood, there is a great deal of waste space—space which the very design of the car prevents putting to good use in the interior. The trend toward elimination of the running boards is making possible far wider bodies. So, rear-end placement of the engine and utilization of former running-board space mean the car of the future can offer from twenty-five to thirty-five per cent more interior space.

This, in turn, can make possible a variety of unusual seating arrangements. One could consist of a fixed driver's seat and a movable divan and easy chair for the passengers. Another arrangement would provide, in addition to the driver's seat, a semi-circular lounge, extending along one side around the back of the passenger compartment to the other side.

In view of the strides in the development of plastic materials in the last few years, it is reasonable to believe that the car of the future will be of plastic materials, with

the manufacturer able to offer an almost limitless range of colors and color combinations. Because color is an inherent part of the plastic material, there will be no need for painting the new-type automobile and no danger of fading and chipping.

Use of transparent plastic materials will make possible curved, airplane-type windshields and curved windows, the contours of which can be made to "flow in" with the pleasing lines of the car, something the designer cannot achieve with ordinary flat panes of glass today. Thus, far more pleasing over-all design effects can be created. Such synthetic "glass" is available today. As clear as real glass, it will do what few forms of special glass can do—admit the healthful ultraviolet rays of sunlight, exclude the infrared. And, in addition, plastic "glass" possesses the safety factor of being well-nigh unbreakable.

By means of complete air conditioning, the driver of the car of the future will be able to create whatever type of automatic "weather" he desires, winter or summer, simply by setting a handy control dial. A thermostatic element will do the rest. Already, several well-known makes of automobiles are offering, what is in effect, winter air conditioning. Fresh, outside air is brought into the car, then filtered, heated and circulated without drafts. The car of the future, however, will provide a mechanical unit which will clean, dehumidify, cool and circulate a constant supply of new air, brought in from the outside.

With all-around air conditioning, the car of the future will not need windows of the conventional type, with levers and handles to raise, lower and adjust them. Rather, the windows—say, windows of plastic "glass"—can be installed permanently. As a matter of fact, the windows will be there purely for the important purpose of providing visibility. Of a substance thicker than ordinary glass, they will not fog or freeze or collect condensation.

The car of the future, by virtue of its greater roominess, can be made literally a luxurious "home on wheels." Seats can be converted into comfortable berths for sleeping. In a twinkling, a portable table can be set up. There will be plenty of convenient storage places, even to little refrigerated cupboards for foods and drinks.

"MY CRIES WERE WHISPERS AS MY LIFE EBBED!"

A true experience of P. S. NICHOLLS, South Bend, Ind.



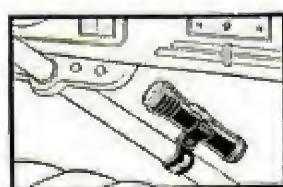
"MY CAR HAD VEERED off the road and smashed head on into a tree. My throat was gashed and bleeding badly. I was able only to whisper—and seemed doomed to die in the inky darkness. Then ...



"...I REMEMBERED MY FLASHLIGHT! Somehow I managed to get it from my tackle box and crawl weakly back to the road. Quickly the bright beam of the flashlight, waved in my feeble grasp, stopped a motorist, who took me to a hospital just in time. There is no doubt that I owe my life to dependable 'Eveready' fresh DATED batteries!

(Signed)

P. S. Nicholls



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Ask for

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3-IN-ONE OIL



Exploring the Heart of the Atom

(Continued from page 735)

started, intimates that similar possibilities may be found in other elements. Bismuth, lead, gold, and mercury are being bombarded with neutrons in this program.

A machine that may remove much of the atom's mystery is the proposed giant atom smasher designed by Prof. Lawrence. The huge cyclotron would weigh six million pounds and be fifteen times larger than his present cyclotron. The magnet would be thirty-four feet long, thirteen feet

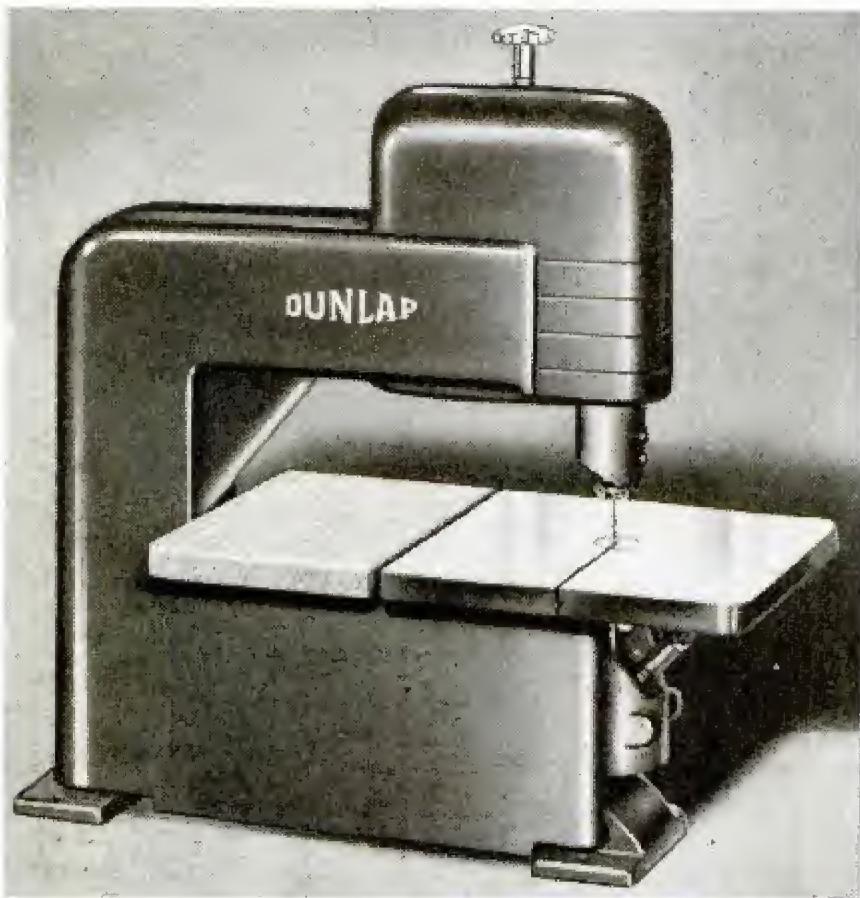


Diffusion pump at base of big vacuum tube maintains high vacuum while atomic studies are conducted

across and twenty-five feet high, and its copper windings would weigh 244 tons. The machine's control room would be at least 10,000 feet away because in some experiments the particles energized by the machine would be fifty times more potent than radium emanations.

It is suggested that such a huge cyclotron could transmute elements on a mass scale. Cosmic rays probably could be manufactured for study. Possibly most important of all, it could be used to investigate the enormous binding power that holds protons and neutrons together in atomic nuclei, the glue or gravity that prevents matter from falling apart.

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See your nearest Sears store today for particulars.

On easy terms if you choose.

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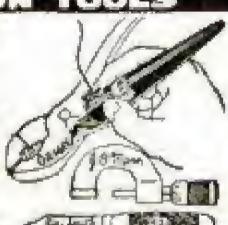
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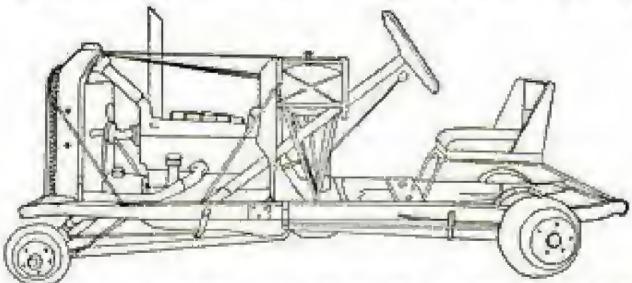
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Tom Thumb Cars

(Continued from page 698)

is affixed to car and swivel so that it remains taut during a run. On an outdoor wooden track in Los Angeles, steel guide rails are used instead of a flexible line as the former make possible competitive racing of four cars at once. Designed by Russell Dooling, the track has a fifteen-degree bank on the straightaway, which increases to forty-five degrees at the center of the turns. On a mile run, the difference in the distance covered by the outside and inside cars amounts to one lap. To compensate for this, a handicapping plan has been devised. An exciting, thrill-packed finish is effected by starting the car on the outside rail first and as soon as it has traveled its "handicap" distance, an electrical mechanism catapults the second one into action and so on until the four are burning up the boards. The track's electrical timer clocks the time of each car for a given number of laps in hundredths of a second and shows on a scoreboard the number of laps traveled by each entrant.

During the hobby's brief life, the cars have undergone many refinements—refinements which might have been years in coming had not such top-flight racing-car and aeronautical designers as Bill Atwood, Harris Dooling, J. L. Lockridge, E. Alexander, and others gotten into the field early.

Atwood has been one of the foremost power-plant designers for gas-powered model airplanes and speedboats for more than a decade. His latest contribution to the field is a racer of semi-monocoque design that was engineered in a wind tunnel, with a single rear-axle suspension that gives knee-action effect on all wheels. The engine is cooled by forced draft venting.

Scores of amateurs have designed and built their own cars except for tires and motors. One of these is George C. McKee, an electrical appliance salesman, who worked for a year during spare time in fashioning his tiny car. One of its features is a combination clutch and universal joint that operates by centrifugal force. A slight push turns the drive shaft, and centrifugal force throws the clutch disk against the flywheel. It also has four semi-elliptical springs, each with seven leaves made of clock spring.

The national governing body of the sport

has done much to standardize cars into classes in accordance with the displacement of their motors. In over-all dimensions, the pee-wee cars range from ten to twenty-four inches, from six to eleven inches in width, and do not exceed ten inches in height. Likewise, wheel bases differ, but fourteen inches is the maximum allowed.

When the sport was young, the ten cubic centimeter (.62 cu. in.) airplane motors found extensive acceptance but lately the miniature-engine builders have been concentrating on power plants designed exclusively for race cars. The latest is a twin rotary valve super-ported engine with a displacement of .603 cubic inch (9.89 cubic centimeters). In recognized competition, cars are allowed one pound of weight for every one-tenth cubic-inch displacement of motor, including batteries and all running equipment.

Standard fuel is a mixture of white gasoline and No. 70 motor oil, but in their attempts to squeeze extra speed from their cars, many drivers turn to a special outboard motor fuel or a concoction of ether, castor oil and gasoline. In lieu of self-starters, a number of devices are used to turn the standard one-fifth or one-fourth horsepower engines over at high speed. One of these is simply a bicycle turned upside down. While his mechanic operates the pedals with his hands, the driver can press the car's flywheel or drive against the revolving tire. Veterans scorn such make-shift equipment in favor of motor-driven starting tables. On one of these is mounted a rubber-tired coaster wagon wheel and two discarded washing-machine rollers. The hobbyist holds the car against the tire or rollers with one hand, keeping the other free for making adjustments in the carburetor.

In order to conserve the life of the tiny dry cells that are fitted into a car, a storage battery or a pair of full size dry cells serve as a booster during starting and tune-up. Just before a car is launched, the booster battery is disconnected and the switch made to the small cells.

If you will send stamped, self-addressed envelope to our Bureau of Information, you will be given the name and address of the manufacturer of or dealer in any article described in this magazine.

1104 Architects

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Foil the Gold Swindlers

(Continued from page 725)

vary substantially, it is a danger signal. If the proportions of gold and silver run exactly the same as U. S. gold coins, or dental alloys, it is also a suspicious coincidence.

One thing a sucker needs to learn at once is to guard well his sample bags. With a hypodermic needle, a gold solution can be injected right through the sealed bags; or the solution can be dropped on them and allowed to soak through. Shrewd individuals use a sealed paper sack as an inner lining for the regular cloth bag. A needle hole or a stain reveals any tampering.

Another "must" is to be sure of your assayer. Once in a while a fake "assayer" will work with the salters. One man, his suspicions aroused by the actions of the assayer, took a piece of grindstone for test. The "expert" gave an enthusiastic report.

In a rather unlikely section, some promoters started a thriving "tin rush." It stirred up so much excitement that a government expert was dispatched to look around. After a survey of the geology of the district he sent some samples outside for analysis. The report showed them worthless. Yet he himself watched the local assayer run similar samples through the standard process and get showings of tin as high as forty per cent. Eventually he discovered the secret. Before running a sample, the assayer put powdered tin into the blower feeding the furnace. The samples were well showered with tin as they were smelted.

One salter, noticing a balcony overhanging the open workshop where an assayer's furnace was located, climbed upstairs and fed grains of gold into the samples by poking them through a knothole in the floor. An assayer became suspicious of the reports his methods were getting but his client insisted the samples couldn't have been touched before they reached the laboratory. The assayer discovered somebody had "spiked" the gasoline for the assay furnace with a gold solution.

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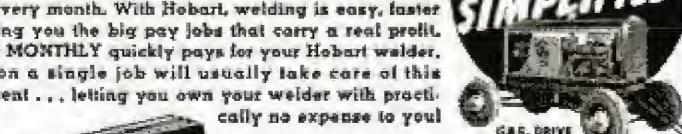
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Training Your Dog for the Game Trail

(Continued from page 709)

hand while in a dropped position, and deliver it to you at the command 'fetch here.' Have the dog drop; face him and hold the buck out in front of him. Give the command 'fetch' as he takes the buck from hand, back up and command 'fetch here to me.' Pull on the lead to bring him to you if necessary. He should deliver it in a sitting position."

Next, put legs on the buck so that it stands off the ground and can be picked up easily by the dog. Two short metal rods through holes drilled at each end will do. Make the dog sit and hold it at the command "fetch." Then with the same command let him take it from your hand and finally from the ground in front of him. Then put it out of his reach so that he goes over and picks it up at the command "fetch here." Gradually extend the distance to several feet and finally have him retrieve from thirty or forty feet away, using the force collar if necessary.

"Use the lead on all this work and pull him in promptly as soon as he has picked up the buck," Asmus advises. "Don't hesitate to use the force collar firmly. The dog should be perfected in each step of this training program before he is advanced to the next and if trouble develops go back several steps and work forward again. It may take two months of diligent training before the dog is ready to hunt with you."

Next step is to use the feathered buck. Tie a covering of feathers firmly around the pronged buck. Start in at the beginning once more and repeat all the first steps. This may take only a day. Then have the dog drop, throw the buck a few feet away, command him to "fetch here" and fire a cap pistol as he reaches the buck. Later on you can fire the cap pistol before the command, and after that begin using a .22 for the louder noise; but at the start it is important not to allow the dog to become gun shy. If he seems particularly timid fire the cap pistol at odd times while he is occupied and then pet him to show him that the noise is harmless.

At this stage, begin steadyng the dog to command. He should always be under control and not permitted to retrieve the buck until commanded to do so. A dog that rushes in as soon as a shot is fired or a bird falls may flush up other birds and

prevent you from getting them. Drop the dog and restrain him with a force collar, throw the buck, and steady him until you finally command him to fetch it in.

Next step is to use a dead bird in the yard instead of the feathered buck. Repeat all the exercises with the bird and later take the dog out into a field and have him retrieve the bird from short distances. Then toss the bird into brush or behind bushes so that the dog has to use his nose to find it. Perfectly trained, he will quarter back and forth until he scents it, pick it up and bring it in, and sit in front of you until you take the bird from his mouth. Now you can start to hunt with your dog.

"Teaching a dog to retrieve takes time and patience and a thorough understanding of the force method," Asmus says. "Each dog is different but these basic rules should be followed in general. Once training is started, follow it through. Never give a command and then not enforce it. The dog may get the idea he doesn't need to mind you."

Daily grooming promotes health and well-being in all dogs. Brush your dog's coat with a heavy bristle brush and on long-haired dogs use a metal comb, wipe out his eyes with cotton dipped in a saturated solution of boric acid, dust dry boric acid powder down into his ears to prevent canker, and smear his nose with a little vaseline to keep it soft. All this should be done daily.

Don't overfeed a hunting dog. He should be lean and hard and if short-haired his ribs should show. Feed him the night before and not on the morning of a hunt. Carry water and offer him a drink every half hour in dry country. Brush up his training for several weeks before you hunt with him. If the dog has been lying around most of the summer he needs to be conditioned, exercised, before he is hunted. Otherwise he may get sore feet, overheat, and wear himself out. If you are to use the dog more than half a day, bring him to heel once in a while to rest him and give him a good rest at noon.

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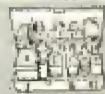
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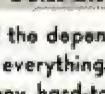
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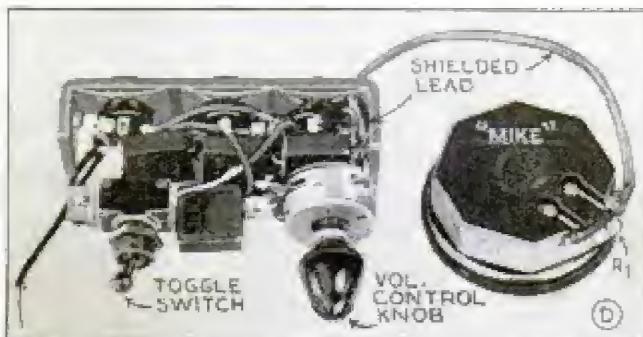
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Wearable Hearing Aid

(Continued from page 777)

side of the case. The black lead (negative-A and negative-B) is grounded and jumped in the battery plug as indicated in the bottom view of the plug. This battery plug is a 4-prong miniature "Cinch" type, and the



headphone may be any good 2,000-ohm lightweight variety. A detailed list of materials is available from Popular Mechanics radio department without charge. Photos A, C and D show views of the instrument in various stages of construction. Volume is easily controlled by adjusting the small knob on the 3-megohm volume control (R4). The schematic circuit drawing is given in Fig. 3. The blueprint number of this article is R-284.

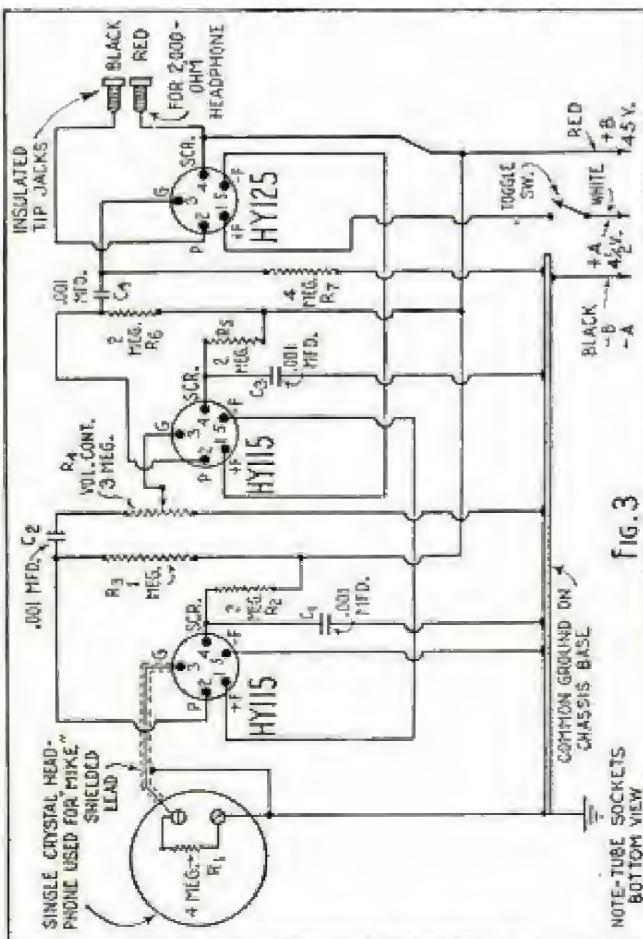
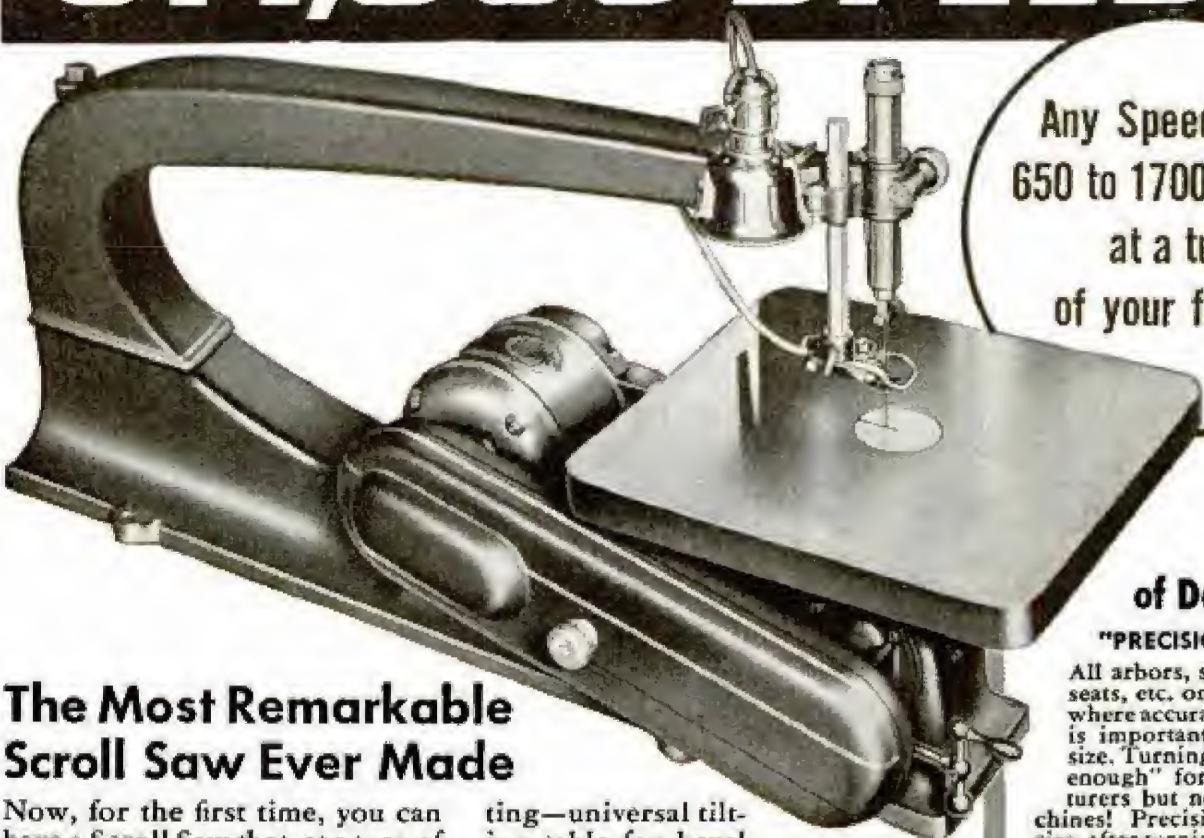


Fig. 3

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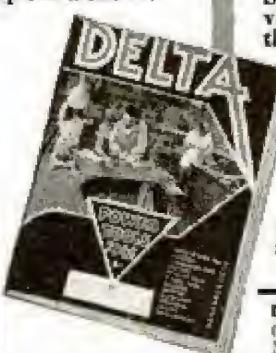
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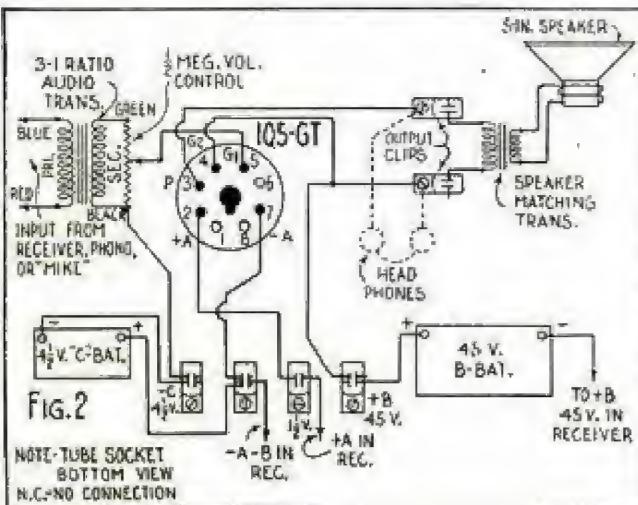
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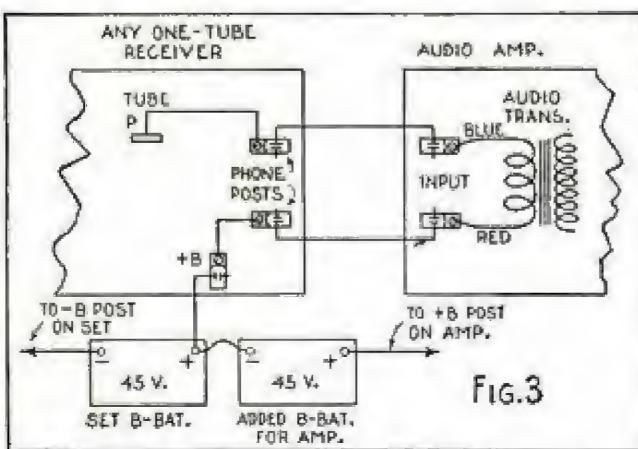
(Continued from page 778)

tained from the receiver, and one additional 45-volt B-battery is employed. When the amplifier is used with microphone or phonograph pick-up, or, if your receiver does not use a 1½-volt A-battery, it will be necessary to connect a 1½-volt dry-cell



A-battery directly to the amplifier A-battery terminal clips and also include both B-batteries to furnish 90 volts for the plate of the 1Q5-GT tube.

Diagram Fig. 3 shows the method of connecting the amplifier to any standard 1-tube receiver employing a 1.4-volt battery tube. All parts for the amplifier are standard items catalogued by radio-parts mail-order houses. The speaker and its coupling transformer may be mounted on a separate base and panel arrangement



or in a small speaker cabinet, which can be made from ¼-in. plywood. Photo A shows the completed amplifier just as wired in diagram Fig. 1. Speaker and transformer appear separately in photo B and are considered as accessories, as most experimenters prefer to use phones.

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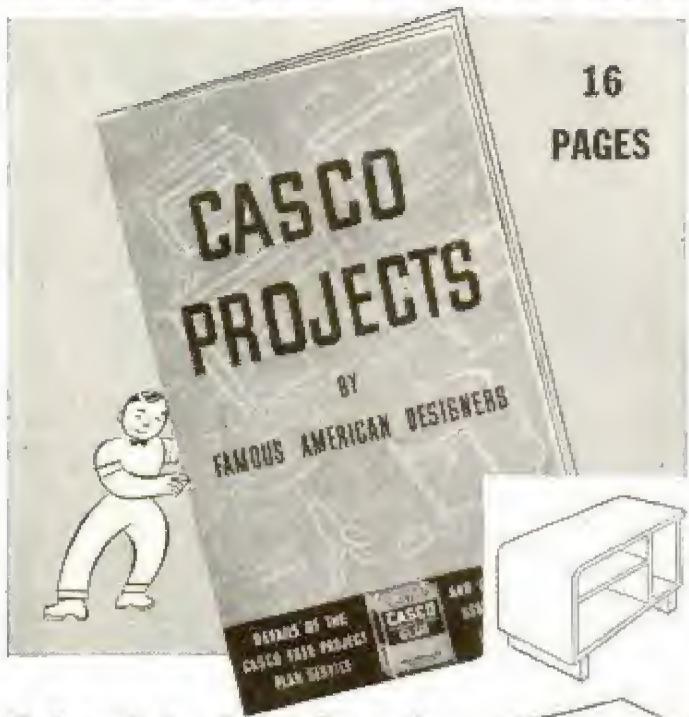
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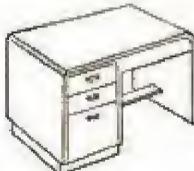
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Pin Your Name on a Comet

(Continued from page 693)

Star clusters are globular collections of thousands of stars, so far away that individual stars can seldom be seen except on photographs taken with huge telescopes. Nebulae may be either vast clouds of gas, or whole universes of stars at an enormous distance from the earth. Both star clusters and nebulae closely resemble a comet when seen through a small telescope.

Messier had so much trouble distinguishing star clusters and nebulae from comets, that he listed them in a catalogue. Today they are still known by the numbers he gave them. Thus the globular cluster in the constellation of Hercules is Messier (M) 13; the great nebula in Orion is M 42, and so on. The first act on sighting a hazy, diffuse object should be to consult a star chart showing the positions of the star clusters and nebulae. If none appears there, it is now permissible to become a little excited, for perhaps you really have something.

One more precaution should be taken. Some telescopes have "ghosts" in them; they show a patch of light near a planet or bright star, caused by internal reflection of light among the lenses. Often they look so real that professional astronomers have made careful micrometric measures of their telescopes' ghosts.

The one sure test for a comet is motion among the stars. The stars are so distant they may be regarded as fixed landmarks. But comets are only a few million miles away, so that they seem to be moving rapidly against a background of stars. Frequently this motion can be detected in a few hours. The best method for the amateur is to make a map of the stars as he sees them in the telescope and locate the comet on it. If on the following night the object has moved into another group of stars, he has undoubtedly bagged a comet.

The next step is to establish ownership. Make a rough estimate of the comet's position by reading off its coordinates on the star map. Note the time of night and the comet's brightness. Telegraph this information to Dr. Harlow Shapley, director of the Harvard College Observatory, Cambridge, Mass. Harvard Observatory acts as a clearing house for discoveries of this

K254

kind. After receiving your message, it sends out others to leading observatories of the United States and Canada. They will read somewhat as follows:

DOAKES REPORTS DISCOVERY OF SEVENTH MAGNITUDE COMET ASCENSION TWENTY ONE HOURS TWENTY MINUTES NORTH THIRTY DEGREES JANUARY TWENTY DECIMAL ZERO

This discovery position is only approximate, because the discoverer is generally in a rush to get his telegram off, before other comet hunters can send theirs in. So keen is the competition that sometimes three telegrams arrive on the same night, in which case, the comet may receive a doubly hyphenated name, such as Comet Kaho-Kozic-Lis, discovered by three individuals independently on July 17, 1936.

Professional astronomers now go to work to get a precise "fix" on the newcomer, measuring its distance from neighboring stars whose positions are known. These measures used to be made visually by means of a filar micrometer attached to the eye end of the telescope; today astronomers prefer to measure from photographs.

The comet is first centered upon the plate and held there by constant guiding during the exposure, which may be from about fifteen minutes to several hours. Telescopes are turned by clockwork at the same rate the stars move across the sky. Since the comet is moving among the stars, the direction of the telescope must be changed every few seconds, or the comet would soon drift out of view. The resulting photograph shows the comet sharply defined, but with the stars drawn out into lines.

Theoretically, the orbit of the comet can be found when its position is known at three different times. In reality, a score of positions extending over a month are needed to determine its path with any degree of accuracy. The computation of cometary orbits is a highly specialized branch of astronomy performed by experts in the use of formulae. With good luck, an expert can turn out an orbit in one afternoon. A beginner might need a month.

Most comets dash across the sky and vanish after a few weeks, never to be seen again. Others, periodic comets, return at

(Continued to page 136A)



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regular intervals. Most famous of these is Halley's Comet, named after Edmund Halley, not because he discovered it, but because he was the first to predict its appearance.

From a study of old records, Halley found that bright comets had been seen in 1456, 1531, 1607, and 1682. His calculations led him to believe the same one was returning about every seventy-six years. He made a prediction, bold for that time, that the comet would appear again early in 1759. Since Halley would certainly be dead by that date, he was criticised as a common publicity seeker. But the comet returned in March, 1759, seventeen years after Halley's death. Its last visit was in 1910, its next will be about 1986.

The only reward the discoverer of a comet can expect at present is a medal and the pleasure of having it named after him. But at one time comets had a real commercial value. In 1830, H. H. Warner, a wealthy amateur astronomer, offered a prize of \$200 for every unexpected comet discovered in this country.

Soon afterward, the late E. E. Barnard, one of the most famous of recent astronomers, found a comet and collected his reward. Borrowing some more money, he built a small house. Barnard was just starting on his career, and as the date of the first payment on his note drew near, found himself without money. In desperation, he started looking for another comet, and by good luck, found one just in time. But that was only the beginning. He succeeded in finding three more comets and actually paid off the note by money derived almost entirely from comets!

K27 Growing 'Em Bigger

(Continued from page 683)

reaud of Plant Industry have developed a method of using the synthetic hormones to speed up the propagation of black locust and shipmast locust, two of our most popular farm trees. California experiments promise to develop ways to use the chemicals in speeding up the production of bushes for replanting burned-over watersheds. Soil conservation agencies are interested in developing large-scale sources of farm trees for soil defense.

(Continued to page 139A)

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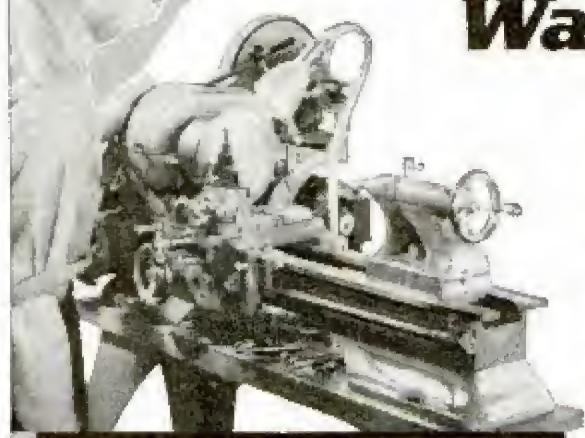
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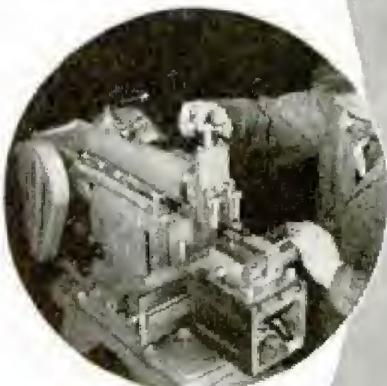
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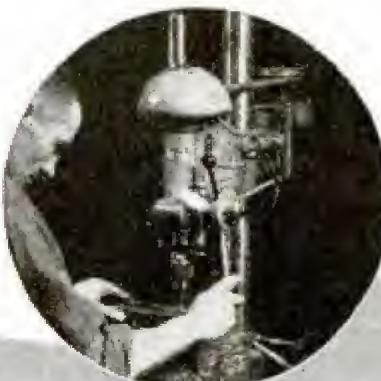
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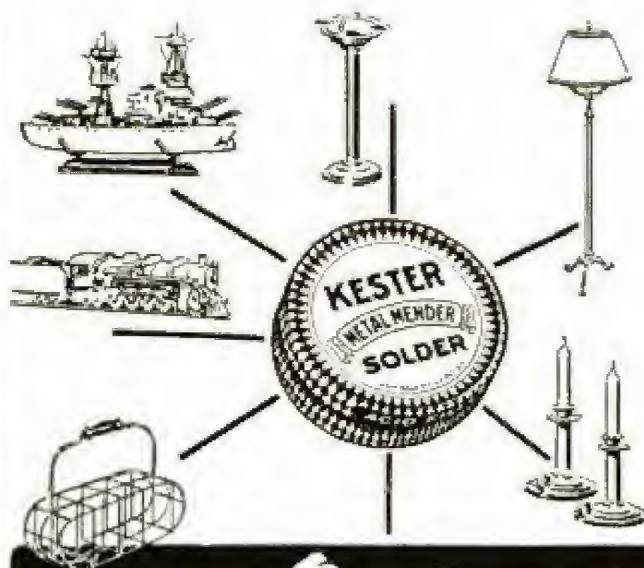


Synthetic hormones promise many aids to fruit growers. That they can be used to assure strong-branched fruit trees was found in studies at the University of Idaho. The chemicals can't do anything for mature trees, but in new plantings a fruit grower can practically assure himself of strong trees. Application of the hormone to the seedlings influences the angles at which the new branches grow. The value of such a discovery instantly is apparent, for limb breakage is one of the most serious problems of fruit raising.

The habit of certain varieties of apples to drop before they are mature has attracted the attention of the chemical plant engineer. Department of Agriculture scientists found that certain synthetic hormones practically solved this problem. As a result commercial sprays built around these chemicals are beginning to appear. At Purdue University it was found that synthetic hormone sprays would delay the blooming of fruit trees until the period of frost danger was over.

Using synthetic chemicals which masquerade as hormones, Dr. Felix A. Gustafson, Michigan scientist, produced experimentally seedless peppers, summer squash, eggplant, cucumbers and tobacco. What science calls parthenocarpic fruits—seedless to us—are produced by substituting the chemicals for the natural pollens. Seedless watermelons also have been produced. German chemists found synthetic hormones that make pruning cuts and tree bruises heal with speed. Some companies now offer mixtures of lawn grasses and clovers in which the seed has been "hormonized" to insure speedier rooting.

Hot news among gardeners is vitamin B-1. Despite all the stirring reports of how B-1 has performed wonders in speeding up plant growth, leading research institutions say that its application on a wide scale still should be regarded as in the experimental stage. Scientists now are trying to clear up three points which surround use of this vitamin. There is need for much more knowledge on how much vitamin each plant produces itself. There is also need for more information on how much vitamin the plant may be able to get from the soil. Also, there is need for greater knowledge on how much vitamin plants can get from fertilizers.



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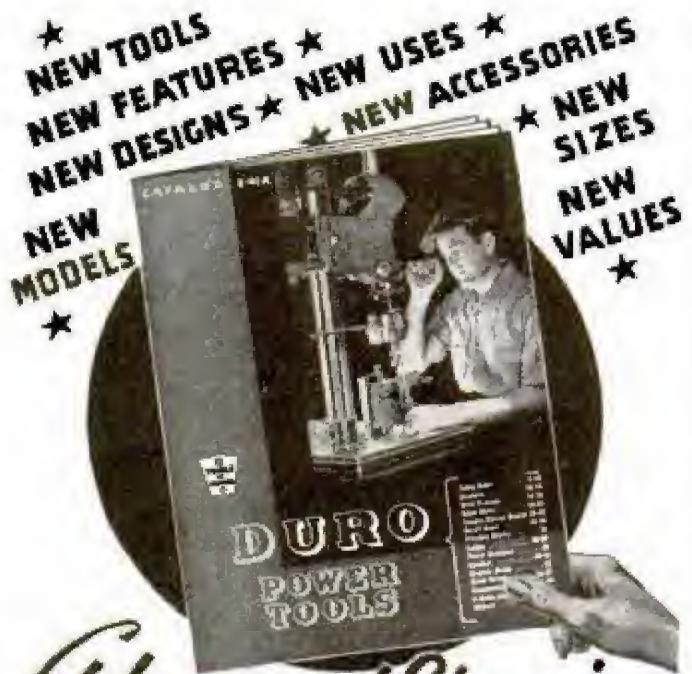
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R 601 Trappers of the Deep

(Continued from page 715)

made by arcs instead of a filament as in bulbs.

"Operating at high voltage, the intensity of the light may be increased or decreased," Palmer said. "Thus far, I have regulated it so that it is most effective on fish up to eight inches in length. In many instances these smaller fish have been particularly difficult to collect. Their size and shape undoubtedly have made it possible for many species to slip through the meshes of the collector's net. Once they are held prisoner in the beam of the ultraviolet ray they may be photographed. My ray is strong enough in ultraviolet to make photography possible even when there is no visible light. Even simple Super XX film is good enough to take the pictures."

Palmer believes that the ultraviolet ray light some day may be used by undersea explorers, treasure seekers and divers as a defense against vicious monsters of the deep.

"Thus far there has been no really adequate weapon for the diver," he says. "The chief obstacle to a defensive or offensive weapon has been the water itself. I could stand six feet away from the muzzle of a .22-caliber rifle fired at me underwater and not be harmed. A knife, spear or barb moves relatively slowly under water, especially when compared to the swift attack of an undersea monster moving in its own element.

"Water does not offer resistance to the ultraviolet ray light. Currents do not alter the true course of the beam. Using high voltage stepped up from a 110-volt line, the intensity of the ultraviolet ray beam might some day be strengthened to the point where it would be useful to the diver to prevent attacks."

Recently the scientific world acclaimed Palmer's feat of recording photographically the birth of a porpoise in the big tanks at Marineland, Fla. With his ultraviolet light and camera he is looking forward to "trapping" and recording for science many other strange sights and dramas far below the surface of the sea.

Send stamped, addressed envelope to our Bureau of Information for name of maker of any device described in this magazine.

Seaplaning—Three Sports in One

(Continued from page 677)

it carries floats. Otherwise its performance and maneuverability in the air are about the same. The big difference is in taxiing. On the ground a land plane can be turned and taxied in any direction, but the seaplane pilot must be part sailor and maneuver his plane like a boat. With the motor idling or not running, a seaplane automatically swings its nose into the wind. This makes taxiing easy when heading into the wind but it makes the plane hard to control when traveling down wind on the surface. Lots of power and a hard rudder are required to turn the plane down wind, but if you use power and rudder to turn up into the wind the plane swings around so fast that it tips over. The way to head the plane into the wind is to do nothing and allow it to turn itself.

It is impossible to taxi or take off across the wind in a light seaplane. Try to taxi across wind and the leeward wing tip dips the water. You sail across instead, handling the plane like a sailboat. With the motor idling or with just enough power to prevent a backward drift, the rudder is pushed to make the plane ride at an angle with the wind. It then drifts across the wind in the direction the nose is pointed. If a green student tries to take off across wind he is apt to find that the plane stalls off the water and makes a tight turn, landing on its prop, a float and a wing tip.

Small seaplanes need protected water. A safe landing usually can be made on the ocean in bad weather but after the plane is down it is almost certain to capsize when a wave catches a wing tip. The larger seaplanes and the navy flying boats are built to withstand the punishment of rough landings, and even these planes are occasionally smashed up when a test pilot slams one into the waves in a crash landing.

Seaplanes opened up northern Canada for extensive prospecting and mining. Each of the thousands of lakes in the north is a leveled, prepared landing field for planes on floats. Seaplanes are used extensively by explorers because suitable stretches of water nearly always can be found.

In the United States seaplane activity is especially great along the Atlantic coast, in the Great Lakes region, down the Mississippi, and in the northwest.



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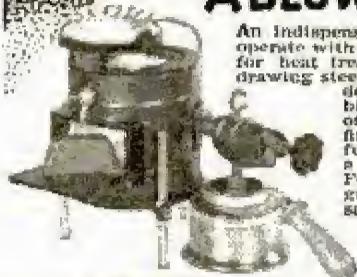
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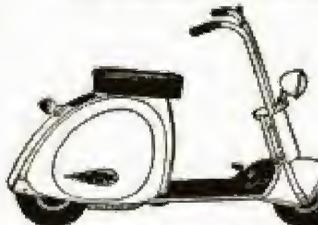
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K659 Counting in the Next President

(Continued from page 671)

marked change in the balloting in a mill town where a strike has taken a political turn, writes a bulletin for the early editions on the failure of a candidate to carry his home precinct, or punches out a paragraph on an apparent plurality for a Democratic candidate in a district once heavily Republican.

At last spring's primary election in Illinois, automatic business machines were used for the first time to tabulate returns.



Cards punched with latest county returns are fed into machine at left to run off state election table

A dozen numbered blanks represented the various contests—presidential preference, governor and so on. For each blank there was a corresponding colored card to be punched in the tabulating machine.

Over the Morse wire from Wabash county to the AP at Chicago came an early report: BLANK ONE WABASH 13 PRECINCTS 6 REPORTING ROOSEVELT 865 GARNER 307 DEWEY 463. The Chicago operator copied this on a No. 1 white blank and sent it to the tabulator. The machine operator tapped electric keys that punched into a white card holes representing the card, or contest, number; the county; total precincts and precincts reporting; and the vote in the proper columns for Roosevelt, Garner and Dewey. This punched card was filed away according to contest and county. A later return

(Continued to page 144A)



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"A TON OF STRENGTH IN EVERY DROP"

would throw the earlier card out. Then, when state totals were desired, the whole file of cards for presidential votes in 102 counties was stacked in another electric bookkeeper whose automatic brain added up the votes for each candidate as the punched cards raced past, and at the same time the machine printed a table of votes by counties—all in less than a minute.

The moment the figures show an unquestioned election, a bulletin is written. Election of a Republican congressman named Jones from the eighth district of Illinois goes on the wire to every AP newspaper thus: HOUSE—Illinois, 8th, Jones (R). At Washington an editor jots down that result on his table and watches the political color of the next Congress emerge.

Accuracy cannot be sacrificed to speed, for the press association assumes a tremendous responsibility in announcing election results. A false announcement regarding the presidency would be little short of national catastrophe. Predictions, speculation are forbidden. The AP takes the figures from the precinct election board, adds them, rechecks, then lets the figures tell their story.

There was no single organization gathering election returns throughout the United States until the Associated Press undertook the task. The AP machine had its first great test at the election of Nov. 7, 1916, when the New York Curb Exchange was quoting odds at 10 to 7 that Charles E. Hughes would defeat Woodrow Wilson.

On that election night in the midst of the world war the first returns put Hughes in the lead and by 8:00 p.m. two New York newspapers which had supported President Wilson conceded his defeat. Extras were on the street with editorials on the Democratic downfall, cables from abroad told of the reaction in Europe to the Hughes "triumph." Mrs. Hughes even embraced her husband and exclaimed "Mr. President" at Republican headquarters in New York.

Meanwhile The Associated Press had put out only figures as they materialized, had not "elected" Hughes. Member newspapers, convinced Hughes had won, bombarded the New York AP office with demands for a story of the outcome; there were even accusations that the Associated Press was pro-Wilson and too stubborn to admit his defeat.

R659

Through election night Hughes continued his lead in the east but western returns were lacking and the Republicans had not tallied enough electoral votes to make victory a mathematical certainty. Wilson had the solid south, but the west was in the balance, and with women voting for the first time there was added uncertainty. Early on Wednesday the tide began to switch to Wilson. The count was rechecked throughout the AP system and the totals stood. At daybreak Thursday Wilson had 251 of the 266 votes needed for election; Hughes had 242. There were 38 in the doubtful column and California headed that list with 13, followed by Minnesota's 12. Hughes needed both states to win; Wilson would lose without California.

Returns were slow in California. A stage was hired in one city, messengers struggled over mountain trails and Sierra snows, men rode mules and horses to get the ballot count in rural sections. Suspense mounted.

Suddenly at 11:20 p.m. Thursday the AP wires ticked excitedly:

"FLASH—SAN FRANCISCO—WILSON CARRIES CALIFORNIA AND IS REELECTED."

The vote in California was close: Wilson 465,194, Hughes 462,224. The electoral vote stood Wilson 277, Hughes 254. Weeks later, official canvassing of the ballots confirmed the Associated Press figures.

The efficiency of the AP election system had stood its big test in the most closely contested presidential election of a generation, and after 1916 official Washington accepted AP election figures as correct and conclusive.

Four years ago there were an estimated 55,427,000 registered voters, and the popular vote for President totaled 45,646,297. Today the Associated Press is gearing up its election machine to tabulate a popular vote of fifty to fifty-five millions.

It may take but a few hours to determine the results on election night. If the vote is as close as in 1916, it may take days. But as the millions of votes flow from the tributary precincts over rivers of telegraph wires thousands of miles long, through the Associated Press tabulators to the front pages of newspapers and into the radio microphones, you can watch and hear the returns grow—returns entirely unofficial, but as dependable as the official returns that won't be known for weeks.

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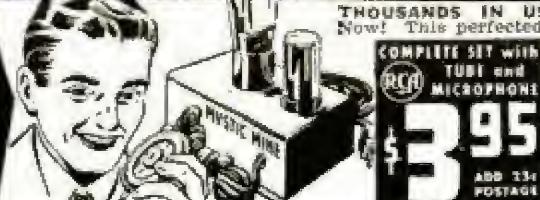
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(Continued from page 645)

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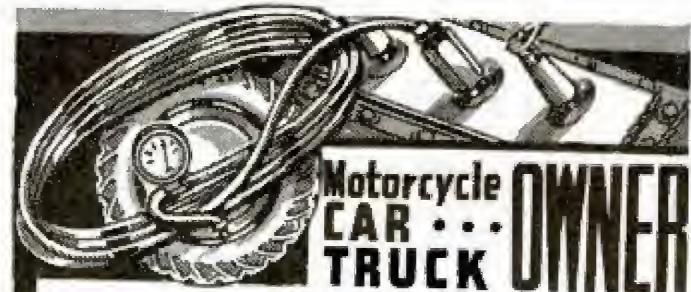
"New impetus recently was given the program by associating 1,500 experienced pilots with rated instructors who are gradually teaching pilots of the 'old school' the new methods of instruction. By this method we are greatly expanding our teaching staff. Another development contemplates a refresher course for thousands of pilots whose certificates of competency have elapsed, principally for want of practice.

"Originally we did not intend to 'refresh' more than 5,000 of the pilots formerly licensed or certified. But there have been so many applications for renewed training we have revised this figure upward. Many seek the refresher course because of the new piloting technique developed during the years since they first soloed. In this group are airmen whose training consisted of nothing more than a check pilot who accompanied them, and kept them from getting hurt, while they actually taught themselves to fly. They had no real instruction in acrobatics or other maneuvers."

For every Army and Navy pilot in the air, ten or more trained men on the ground are necessary. The Army Air Corps began training 31,000 enlisted men as mechanics and specialists last July 1. By June 30, 1941, it is estimated that the Air Corps will have 46,000 qualified enlisted specialists, trained at the three Air Corps technical schools and at seven civilian technical schools. The specialists include airplane mechanics, welders, metal workers, radiomen, parachute men, armorers, photographers, engine men, machinists, meteorologists, teletype operators, supply clerks and stenographers. Facilities of the civilian mechanics schools used by the Army Air Corps will be expanded. The Navy trains its own mechanics in its own schools.

No aeronautical engineering training is provided under the Civilian Pilot Training program. Such courses can be obtained at some of the larger colleges and to some extent at certain of the commercial aviation schools. California Institute of Technology, in cooperation with Lockheed Aircraft

(Continued to page 148A)



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jewelry, figurines, those new engraved glass book ends, mirrors, trays, etc., from any metal, alloy, plastic, glass or wood.

Make gifts, prizes, things for the home or to sell—ship, train, plane or house models, costume jewelry, etc., from any metal, alloy, plastic, glass or wood.

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ONLY \$9.25 FOR THIS 100% OIL-LESS PAINT SPRAYER!

New Marvel sprayer never needs oiling! Fast, smooth, better, for paint, varnish, enamels, lacquer, insecticides, moth-proofing. Special shock inflates tires, too! Diaphragm type compressor insures clean oil-free air — only two moving parts. For the home, workshop, schools, small manufacturing. Complete as shown without motor, only \$9.25. With No. 002 gun, only \$17.50.



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Send for Free "Reminder" Kit now enclosing 20
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KIT is fun to use. It will help you get a DAISY
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IDEAL FOR BUSINESS OR PERSONAL USE
GUARANTEED ACCURATE. Not a toy. Operates with only a finger flick. TOTAL COST
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Corporation, has a course which will prepare men for work in the industry within eight weeks. Following this college course, the men get an additional eight weeks' training in the factory before they are permitted to join the engineering department. The course is open to general engineers who have a sound background and foundation upon which aeronautical training can be based. These men are paid while they learn and are guaranteed jobs upon completion of the course.

Glenn L. Martin Company, another manufacturer of airplanes, has inaugurated a training school. Curricula include blueprint reading, drafting, engineering procedure, lettering, standard aeronautical practices and nomenclature and studies of handbooks and textbooks on Martin methods. Lectures deal with all phases of work the men will do when they are admitted as regular members of the engineering staff. This course dovetails with a shop training course in the engineering department. The new engineers are sent into the factory for a time to learn the machine and craft operations. Transferred from one department to another, they do the actual work of building airplane parts and helping to assemble them. The students are on full pay while they attend school.

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Subtly reminding you that "time flies," an electric clock is built like a model airplane. Each silvery wing houses a tiny engine and propeller. Rubber-tired wheels complete the model, aiding also in protection of polished table or mantel.

216 N Clinton

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**Powerful
DOUBLE-LEVER Action
LOCKS Jaws to Work
with TON-Grip!**

World's most powerful hand-tool! Unique "Double-Lever" Action makes the grip of one hand to close the jaws with TERRIFIC Non-Slip Pressure. Jaws LOCK to the work—remain locked with hands re-moved. Adjusts exactly to size, stays adjusted. NEVER SLIPS! No lost motion. Does more things than any other hand tool. "Impossible" jobs made easy. Is perfect hand-wire to hold small work for filing, grinding, sawing, drilling. Scores other uses. Is actually a portable Vise, Clamp, Super-Plier, Pipe-Wrench, Open-End Wrench, Locking Wrench, Toggle Pliers—all, IN ONE! Holds anything, round, square or otherwise. Works in close quarters, at any angle. Adjustable to ratchet-like or super-plier action. Light, trim, handsome. Finest alloy tool steel. Nickel finish.

SEND NO MONEY! Order from your dealer. Or, send name, address and size wanted. Pay postman regular price plus few cents postage—10" size, \$1.05; 7" size, \$1.65; Money back if not pleased. Order Today. Free folder.

PETERSEN MFG. COMPANY

Dept. PM-11

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STORES, Homes, Taverns, Shops, Garages—scores of others—waiting for the RAY-ALARM Burglar Alarm and Announcer. Real protection—guards against intrusions. Invisible beam of "Black Light," when interrupted, sounds continuous alarm. Plugs in any light socket. Unfailing demonstration takes 10 seconds—makes sales on the spot.

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Quick Action (1940) Perfected Self Starting Lighter

Lights cigar, cigarette or pipe—Instantly. Never fails. IMPROVED PRINCIPLE IN IGNITION. No flint. No friction. Send 25c for sample and large can of fluid. Start now. Agents report big earnings.

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Doz.....\$1.75
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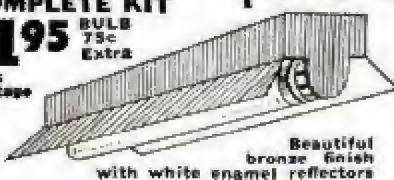
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Beautiful bronze finish with white enamel reflectors

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Back Geared
Screw Cutting
PRECISION LATHES

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The SHELDON "METALWORKER" is a sturdy, full sized, full weight, back geared, screw cutting, 10" precision lathe, built to industrial standards with hob-cut change gears, heat treated and ground spindle, hand scraped V-way, etc., etc., 10 1/4" swing, 1 1/16" hole thru spindle, 20" center distance, 38" bed, complete with compound rest, tool post, change gears, face plate, centers and wrenches. \$108.00 F. O. B. Chicago.

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100 TOOLS in ONE

Grinds, polishes, sharpens, drills, engraves, etc. Saves time, cuts cost. Handiest tool in home or shop—use it daily. Same tool as used on precision jobs in factories.

OVER 25,000 R. P. M. High speed conserves balanced armature, 110 V. (AC-DC) MODEL 1 MOTO-TOOL with chuck, 1/8" collet, only \$8.85, MASTER MODEL 2, 27,000 r.p.m., heavier, more powerful, only \$16.50, 10-DAY TRIAL. See the genuine DREMEL MOTO-TOOLS at better Dealer's or order direct from factory on 10-day money-back trial. Catalog of Dremel tools, equipment and special combination offers, FREE. Dremel Mfg. Co., Dept. 110-L, Racine, Wis.

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Big 24-page book shows how to make 41 plastic projects. Sent postpaid for only \$1.

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Hold, start and set-up screws in unhandy places. Gripper instantly engaged by spring action, sliding up out of way when not in use. Threaded metal shank, chrome vanadium blades may have transparent insulation, unbreakable handles. Illustrated.

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Hold, start and set-up screws in unhandy places. Gripper instantly engaged by spring action, sliding up out of way when not in use. Threaded metal shank, chrome vanadium blades may have transparent insulation, unbreakable handles. Illustrated.

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Complete kit \$2.75
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Polished metal end caps. White enamel body. Price includes switch

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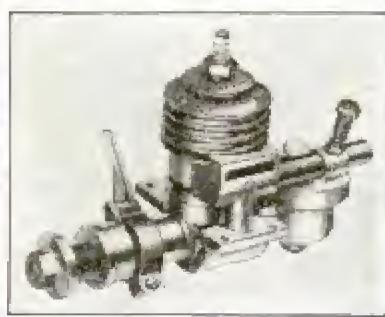


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The Ideal Gift

Working tools to gladden the heart of any man or youth who enjoys the thrill of useful construction.

Make model boats, maps, plaques, puzzles, household novelties; any kind of scrollwork, marquetry or inlay. For model builders, cabinet workers, sign builders, hobbyists, home furniture builders. Cut fast, with smooth edges. Electro magnetic powered, requiring no motor. Is safe, efficient, economical. Delivers 7200 cutting strokes per minute. Plugs into light socket. No rotating parts. No oiling. Accidental injury practically impossible. Handles veneer, plywood, bakelite, masonite, as well as wood. Throat clearances of models 8", 13½", 16". Sold by your favorite dealer.



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Develop 1/7-1/6 HP. 700-1500 RPMs. Bore 5/8". Stroke 5/8". Displacement .292. Weight 5½ oz. Positive set carburetion. No timer points to set or adjust. 3 piston rings. Force-feed lubrication.

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SYNCRO DEVICES INC. 747 BEAUBIEN ST. DETROIT

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As Easy to Use as a Pencil!

With this new low priced TOOL (not a brush) you can now do professional striping—on furniture, autos, models, tiled walls, boats, boats—and all home remodeling projects. Tool uses paint, enamel, lacquer, etc. Thousands of satisfied users in home, workshops, furniture stores, etc. We also have commercial and industrial models. Send only \$1.00 for complete tool with gravity feed container, 1/16" striping wheel, adjustable guide, operating instructions, etc. Sold on Money Back Guarantee. Narrower or wider strips within available width. Write today for free literature.

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2 Tools
2 Cutters
4 Tools, Knurling
Tool, Woring Tool
Threading Tool, High
Speed Steel Cutters and
Blades, and 2 Wrenches
in Fitted Steel Case.

R75 Fighting Forest Fires from the Air

(Continued from page 651)

and in emergencies. On any sizable blaze, when headquarters are set up, a fully equipped portable kitchen goes along, and the Forest Service has on call cooks who can handle from a dozen to a hundred men. Fire fighters, like soldiers, live on their stomachs.

This year in the Wenatchee Forest, a group of 300 ranchers, loggers and other people living in the forest have been trained in fire control. They are ready for duty at any time, in addition to special CCC crews who have been trained also and equipped to stay at least three days on the fire front without additional supplies. Sleeping bags, rations and tools for 400 men are stored in a centrally located warehouse.

Once each year, at the beginning of fire season, fire-fighting schools are conducted. Here actual fire-control methods are tested under actual conditions. Old hands and new recruits take to the brush. A camp is set up to handle a hundred men. Fires are built and men put them out by regulation methods. They load packs on backs, and tools in kits. They climb mountains and locate smokes. They carry on radio communication, and work out orientation and compass problems.

Even a small fire may spread destructively. Therefore care with fire, matches and burning tobacco is the first rule observed by every good woodsman.

One new procedure by which the effectiveness of a fire-fighting crew has been greatly speeded up is the "one-lick" method. Briefly, the method provides for three crews—clearing, digging, and patrol—which follow in that order in single file. Each man, provided with the proper tool, makes one stroke and steps on. As the crews progress, the fire line rapidly takes form and is complete when a man is dropped by the patrol crew to patrol that section of the constructed line.

By following this method, the U. S. Forest Service has been able to use its manpower and equipment more effectively on forest fires.

Send stamped, addressed envelope to our Bureau of Information for name of maker of any device described in this magazine.

KO70

Floodlight Installed over the Sink Throws Light Where Needed



Submariner

Mounted on a pedestal at the back of the sink, this lamp sheds light downward just where it is needed

Dishwashing is easier when there is plenty of light. A new sink unit has a floodlight mounted on posts at the back, casting light downward exactly where it is needed. The sink fixtures and its cabinet have white plastic handles.

K627

Flowers Hung in Picture Frame Form Living Floral "Print"

Living floral pictures are a novel decorative idea just introduced. Inside an oval picture frame is a small vase resting on a shelf. Fresh cut flowers are placed in the vase; thus framed, they form a "floral print" that can be changed as desired. There are two types of frames, one for wall hanging and another for table use.



Submariner

Watering a floral picture seems a bit unusual, but in this case it's all right for the flowers are real

Submariner

NOVEMBER, 1940

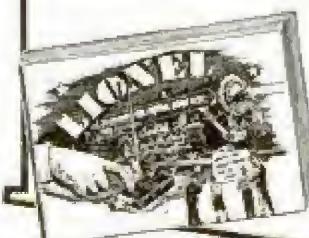
Greatest Hobby on Earth



Now More Exciting Than Ever!

Breath-taking, new action features developed and perfected by Lionel. New, electrically operated Bascule Bridge that opens at the touch of a button. Electric Magnet Crane that loads and unloads metal scrap. New thrilling scale model Freight Cars with sprung trucks. New train combinations. New colors. New styles. New thrills and excitement for model railroaders.

SEND FOR THIS BIG, 64-PAGE COLOR CATALOG



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New Invention *Electroplates* by Brush

Plates

GOLD
SILVER
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Easy as
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No Tanks, Liquids, Generators

DOES SAME WORK AS BIG OUTFITS

Millions of old auto-parts, and all kinds of old, worn articles in homes, stores, offices, factories everywhere can now be electroplated with a permanent brand-new sparkling coat of metal—by electrolysis—with the stroke of a brush. Easy as painting—no dismantling—plates right on the spot. Any electric light socket or car battery. Weighs only a few pounds. Take it anywhere—ready for instant use.

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MAKE BIG PROFITS AT ONCE

Amazing low price and magic-like demonstration brings you thousands of orders for plating from garages, radio shops, bicycle shops, machine shops, home work shops, factories, offices, janitors, doctors, dentists, jewelers and farmers, homes, stores, etc.—with big profits for you! List of plating charges furnished; also reports of remarkable daily earnings.

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DEVELOPS UP TO 7 H.P.



Put water to work. The new No. 440 Brook Hydro-Electric Plant is amazingly simple and inexpensive. Will provide electricity for lights, pumping water, radio, etc. Most economical turbine water wheel made. Write for bulletin.

BROOK WATER WHEEL CO. WATER ST. ORANGE, MASS.

"Trolley" Holds Electric Cord Out of the Way of the Iron



Vertical arms that bend as the iron moves keep the electric cord out of the way

Spring-mounted, a "trolley arm" for the ironing board keeps the electric cord high and out of the way of the iron. The trolley slips easily onto the edge of the ironing board, and is held firm by a clamp spring. Retrieving springs let the vertical arms bend with movement of the iron.

Hydraulic Brake for Bicycles Controlled by Hand

Little effort is required to stop a bicycle equipped with a hydraulic brake patented recently. A quarter turn of the control, mounted on the handle bar at the right, stops the bike smoothly and surely, according to the inventor.

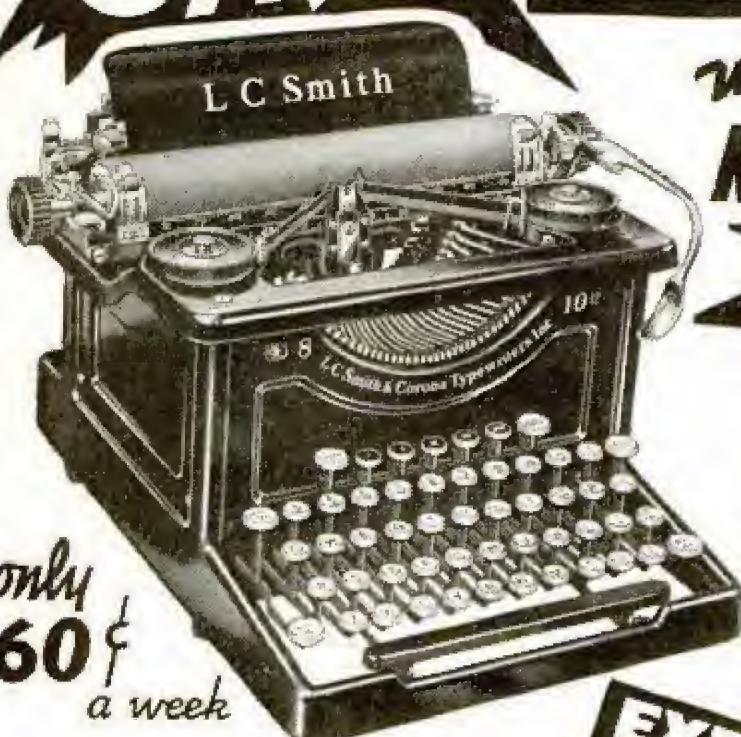


Close-up view of the brake drum and hydraulic feed line of new hydraulic brake installed on bicycle

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ORIG.
#3 PRICE**

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For those who have no typewriter stand or handy place to use a typewriter, I make this special offer. This attractive stand that ordinarily sells for \$4.85 can be yours for only \$2.00 extra added to your account. Quality built. Just note all its convenient features. (See coupon)

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Offer for Limited Time—Send Coupon Today

Accept this wide open offer now! Send no money. Use L. C. Smith for 10 day trial in your home. Return it if you don't think it the greatest value you have ever seen. If you buy, pay on easiest terms—only \$2.50 a month, 2 yr. ironclad guarantee. Avoid disappointment—mail coupon today.

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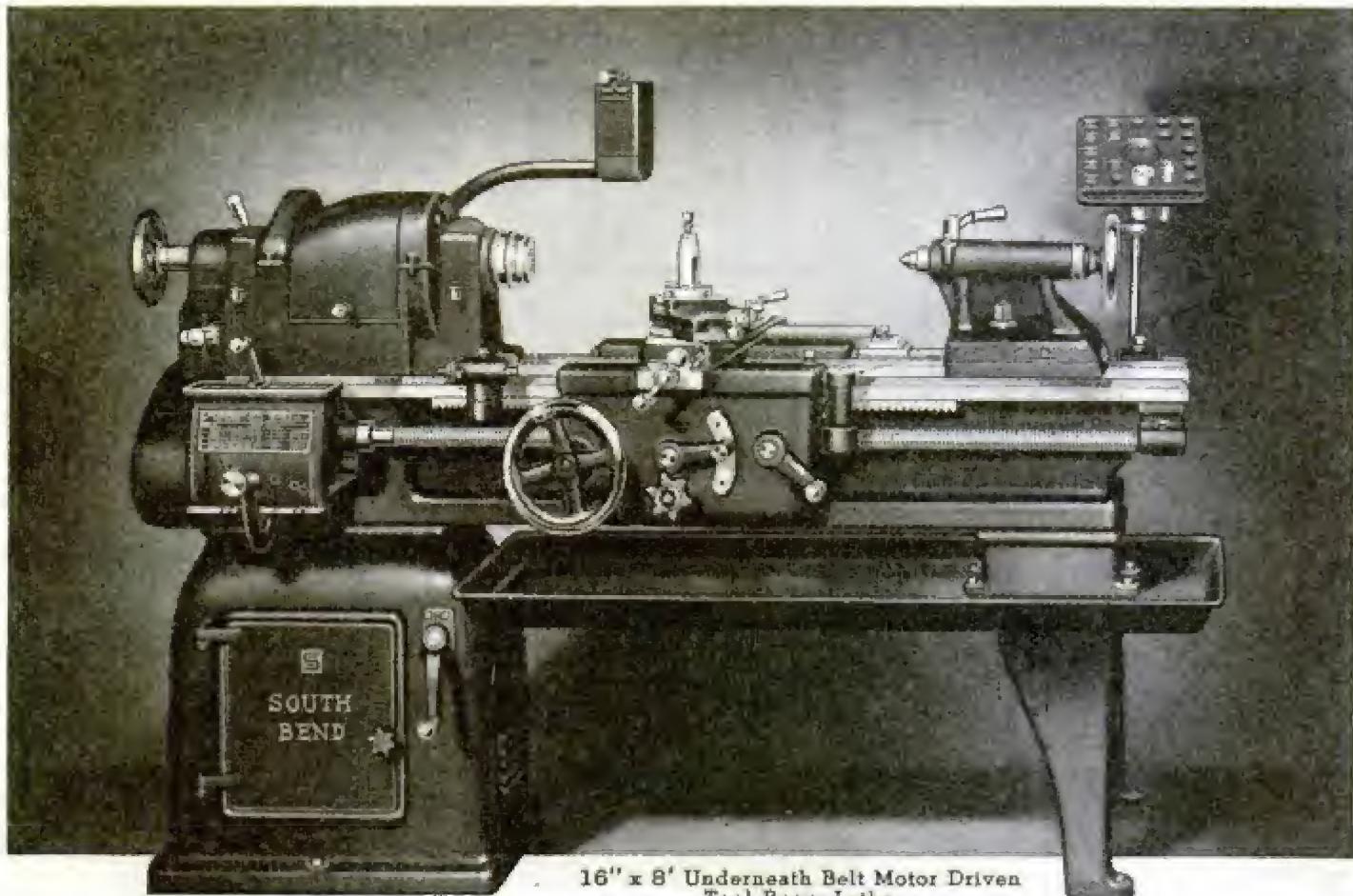
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Tool Room Lathe

SOUTH BEND LATHES FOR PRECISION WORK



DOUBLE WALL APRON

Back view of the Double Wall Apron showing the rigid, one-piece box type construction that provides a substantial support for both ends of the gear shafts.

Gears in the apron are of steel and have a reservoir and felt wick automatic oiling system. Worm drive assures smooth operation of feeds on all classes of work.

South Bend Lathes have been giving users dependable service on the most exacting classes of precision machine work for thirty-five years.

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Manufactured in 9", 10", 13", 14½" and 16" swing, bed lengths 3' to 12', in Motor Drive and Countershaft Drive. Attachments are available for production, tool room and general machine work.

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		*Boston Sales Office, 67 Broadway, Kendall Square, Cambridge, Mass., Telephone Trowbridge 6339.
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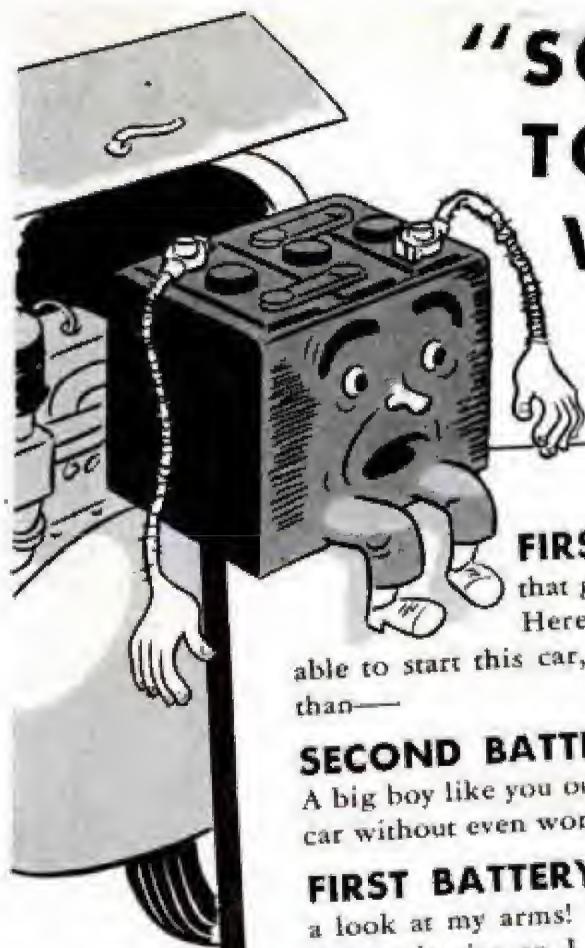
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LATHE BUILDERS SINCE 1906

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SECOND BATTERY: What's your excuse? A big boy like you ought to be able to crank that car without even working up a sweat.

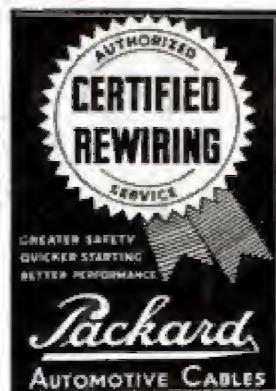
FIRST BATTERY: Excuse, you call it! Take a look at my arms! This battery cable is frayed and undersize so I can't get my power to the starting motor, and the ground strap is just as bad. They'd better take me to a Packard CERTIFIED RE-WIRING station—quick!



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Defective cables, connections and electrical units anywhere in your car's electrical system can cause you a lot of grief—hard starting, poor pick-up, lower gasoline mileage, and unsafe lighting. Stop in today at the sign of Packard Certified Re-Wiring Service, and let an expert mechanic check your circuits with accurate instruments. All necessary cable replacements will be made with high-quality

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